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Machinery Useful for in-situ Paddy Straw Management

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INTRODUCTION

The "rice-wheat cropping system" is the dominant cropping system in South Asia (Hobbs and Morris, 1996). This system involves growing rice and wheat in rotation throughout the year. The organic matter in the form of crop residue serves as a major source for replenishing fertility status (Dhillon & Dhillon 1991) and provides beneficial effect on biological properties of soil (Mishra et al., 2001). Both rice and wheat are exhaustive feeders, and the double cropping system is heavily depleting the soil of its nutrient content. A rice-wheat sequence that yields 7 tons per ha of rice and 4 tons per ha of wheat removes more than 300 kg N, 30 kg P, and 300 kg K per ha from the soil (Singh & Singh, 2001). For sowing of wheat after harvesting of paddy, burning of rice residue is most common method used by farmers of India. The burning of rice crop residue results in substantial emissions of gases and particles and it pollutes the environment. This pollution can have effect human health adversely. The burning of paddy straw leads to loss of precious nutrients as nearly 25% nitrogen and phosphorous, 50% Sulphur, 75% of Potassium uptake from soil are retained in the crop residues (Dept. of Science, Technology & Environment, Govt. of Punjab). It was estimated that in Punjab alone, about 1.5 lakh tones of Nitrogen and Sulphur in the residues lost during burning, costing more than 150 crore Rupees at the prevailing prices.

In, India effort has been made by government to reduce residue burning and it had moderate impact on burning. To avoid burning of crop residue, improved machinery may be used for sowing of wheat in standing stubbles of rice crop. The uses of these machines are also economical for farmers. The highest B: C of 6.79 was also recorded in the residue incorporation treatment followed by 6.19 and 3.86 in the burning and straw removal treatments, respectively (Khankhane et al., 2009).

These machine can save time, maintain soil health and remove the need of multiple operations to incorporate the paddy straw. The focus of this article is to spread awareness about the rice straw management machinery.

Double drum loose straw chopper

This machine was having two main components, loose paddy straw picking unit and two straw chopping cylinders having serrated blades. The loose paddy straw is picked up by the rotary picking unit having arrangement of straight 'I' blades in two rows mounted helically on rotor. The straight blades pick up the loose straw and feed it to chopping cylinders. Two chopping cylinders chop the loose straw into small piece and uniformly spread on the field without disturbing the standing stubbles. The power is transmitted from tractor PTO to straw picking unit and chopping cylinders through gear box and belt pulley arrangement. The working width of the machine is 1720 mm. The front chopping cylinder diameter was 760 mm and 10 number of rows of serrated blade was fixed on periphery of the cylinder. The rear chopping cylinder diameter was 440 mm and 6 number of rows of serrated blade was fixed on periphery of the cylinder. The gear ratio from PTO drive of tractor to main pulley was 5:9. A stationary view of the machine is shown in Fig. 1.

Table 1.1: Brief Specification of Double drum chopper for chopping of loose paddy straw

Particulars	Specification
Type of machine	Tractor PTO operated, trailed type
Power source	45 hp tractor
Overall dimension, L x W x H, mm	3480 x 2480 x 1200 mm
Number of loose straw picking unit & number of blade per row	2 & 13
Number of rows of loose straw picking blades	
Number of blade per row	13
Ground wheels	2
Ground wheel diameter	700 mm

Fig. 1: Operational view of doble drum loose straw chopper

Happy seeder

The Happy seeder is used for direct drilling of wheat crop in to a combine harvested field (without straw removal/burning) in a single operational. The rotating blades cut only that part of straw which is coming just in front of furrow openers. These cutting blades are operated by PTO drive of tractor. It consists of two units- one straw management unit and other sowing unit. The happy seeder cuts, lifts and place the standing stubble & loose straw and sows the field in one operational pass of the machine. Brief specification of happy seeder is given in Table 2.

Table 2: Brief specification of Happy Seeder

Particulars	Specification
Number of rows	9
Row spacing, mm	200
Working width, mm	1600
Depth of operation, mm	35-50
Source of Power	PTO operated trailed type
Source of power for feed shaft	Ground wheel
Chopping unit	Cutting Blades

Fig. 2: Operational view of happy seeder

Double disc seeder

The double disc seeder is used for direct drilling of wheat crop in to a combine harvested field (without straw removal/burning) in a single operational. Two rotating discs open a slit for seed sowing in a row. Depth control wheels were provided to control the depth of sowing for each row. Seed and fertilizer boxes were provided separately. Fluted roller type metering unit was used to control the seed rate. Ground wheel was provided to rotate the feed shaft.

Table 3: Brief specification of double disc Seeder

Particulars	Specification
Number of rows	9
Row spacing, mm	225
Working width, mm	1800
Depth of operation, mm	10-20
Source of Power	trailed type
Source of power for feed shaft	Ground wheel
Depth adjustment	One wheel for each furrow opener

Fig. 3: Operational view of double disc seeder

Spatial till seed drill

The spatial till seed drill is used for direct drilling of wheat crop in to a combine harvested field (without straw removal/burning) in a single operational. The arrangement of furrow openers are set in three rows, in each row three furrow openers to increase the distance between furrow openers, so that straw don't choke in between the tines. The height of seed and fertilizer box need to be increased because the angle of seed tubes is not adequate and seeds stop before dropping. This may also give non uniform seed delivery. The view of spatial till seed drill is given in fig. 4.

Table 4: Brief specification of spatial till seed drill

Particulars	Specification
Number of rows	9
Row spacing, mm	250
Working width, mm	2000
Depth of operation, mm	50-70
Source of Power	trailed type
Source of power for feed shaft	Ground wheel
Depth adjustment	One wheel for each furrow opener

Fig. 4: Operational view of Spatial till seed drill

CONCLUSIONS

For the rapid adoption of paddy straw management practices awareness generation among farmers and benefits of straw management machinery need to be highlighted. There is need to change the past mindset of farmers. The best solution to deal with the problem is to manage the straw on the farm itself which makes it more economical and convenient. Presently, the most beneficial and cost-effective way to manage paddy straw is to use happy Seeder and other machines. Government plays a major role in this issue and should offer various subsidies and incentives to farmers and other stakeholders to motivate them to manage paddy straw effectively.

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Manual Operated Farm Implements Useful for Rice Cultivation

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INTRODUCTION

Rice is the most important and extensively grown food crop in the world. It is staple food of more than 60 per cent of the world population. India has the largest area under paddy in the world and ranks second in the production after China. Rice can be sown in dry seedbed, wet seedbed or can be transplanted in puddled field. For cultivating rice in one hectare 800-900 man hours of labour required for different farm operations viz. puddling, transplanting, weeding, harvesting and threshing (Guru et al., 2018).

In India majority of farmers are marginal and small farmers. These farmers are resource poor and not in position to own the requisite farm machinery. Over the 60% of farmer's family own less than one hectare of land (Patel et al., 2018). The involvement of women workers for rice cultivation is more than men. The problem with marginal and small farmers is lake of awareness about the available farm machines and the skills required for their operation and maintenance (Guru et al., 2019; & Shrivastava et al., 2021). In the view of these problems brief information about some of the improved manual operated implement is provided below.

Three row manual seed drill

Row seeding is the most efficient means to sow the crops win optimum seed rate and also with maintained row to row spacing. Row seeding also promotes maximum tillering and better sunlight penetration. This is a small manually operated three row seed drill for dry direct sowing of rice. Fluted roller metering mechanism is provided to adjust the seed rate. Two ground wheel is provided on both sides of seed hoppers to drive the metering rollers. Seed are filled in the hopper and a long beam is provided by which the implement could be pulled by one operator. Shovel type furrow openers are provided for easy operation. The row to row sowing distance is 20 cm.

The depth of sowing and seed rate can be adjusted as per requirement. The capacity of this machine is 0.04 ha/h. The machine save seeds and labours in sowing of crops along the rows that helped in weeding and inter-culture operation.

Three row manual seed drill

Three row manual puddle seeder

It is a manual drawn seeder suitable for sowing of pre-germinated rice seed in puddle field. It has float on the front to avoid sinkage of the machine. Metering device consists of plastic wheels having grooves on its periphery. The seed rate is controlled by varying the positioning of seed box. It is made by using G.I. sheet, MS flat, Angle iron, MS Pipe, plastic wheels etc. The row to row distance is 20 cm. Depth of sowing and seed rate is adjustable. Field capacity of this seeder is 0.08 ha/h.

Three row manual puddle seeder

Four row manual drum seeder

Paddy drum Seeder is suitable for sowing sprouted paddy seed in puddled field. It is useful for uniformly seed sowing. It is reduce the manual effort and help farmers for maximize their output. It is light weight pulling machine and also it is very easy to handle. Each seed drum has two rows of planting. Two drums can be assembled to form 4 rows of seed drum. Wheels are provided at both ends. These wheels are made up of Light iron rods and adjustable floats are provided for easy operation under puddle field condition. Seed is prepared by socking in water for24 hours and incubation for 12 – 24 hours. The row to row distance of this seeder is 20 cm. The field capacity of drum seeder is 0.030 ha/h. Sowing of this method reduced seed rate by 60-65 % as compared to broadcast seeding. Uniformity in seed sowing and Plant population by elimination of continuous drilling of seeds.

Four row manual drum seeder

Four row manual rice transplanter

The four row manual transplanter was comprised of floats, a main frame assembly made of MS pipe that supported the seeding tray made of G.I sheet, pushing lever tray indexing mechanism, picker bar assembly and handle. Manual rice transplanter can be used for timely operation and reduced cost of cultivation with better crop yield. One person can easily operate this transplanter. Row to row distance is 24 cm. The field capacity of transplanter is 0.03 ha/h. It is suitable for transplanting of 20-25 days old mat type rice seedlings. It saves about 30-40% labour requirement and 40 % cost in transplanting operation.

Four row manual rice transplanter

Wheel finger weeder

Wheel finger weeder is suitable for weeding of upland rice. It is a manual pull and push type weeder. The weeder consist of a frame, a wheel, a handle and five number of curved fingers. The wheel is made of M.S flat with 4 spokes and an axle. The spacing between fingers is adjustable. As the operator moves the handle to and fro the fingers push into the soil and loosen it and weeds get uprooted. It is made by using MS rod, MS pipe, MS flat etc. One person can easily operate this machine. The field capacity of this machine is 0.025ha/h. The fingers of this weeder are positioned in staggered manner so that there is no clogging and all the area in between rows is covered.

Wheel finger weeder

Cono-Weeder

It is suitable for weed cutting, churning and mulching in wet land. It covers one row at one operation. The stars and conical drums cut the weeds and churn them into the soil. The weeder consists of two rotors, float, frame and handle. The rotors are cone frustum in shape, smooth and serrated strips are welded on the surface along its length. The rotors are mounted in tandem with opposite orientation. The float, rotors and handle are joined to the frame. The float controls working depth and does not allow rotor assembly to sink in the puddle. The cono weeder is operated by pushing action. The orientation of rotors create a back and forth movement in the top 3 cm of soil and helps in uprooting the weeds. It reduces labour requirement by 50-75 % and was found ergonomically suitable for local labour. The field capacity of this weeder is 0.013 ha/h.

Cono-Weeder

CONCLUSION

The use of manual implements for sowing, transplanting and weeding operation can increase the field coverage per day. The sowing implements save seeds as compare to manual broadcasting and provide uniform crop stand for weeding purpose. Weeding implements and transplanter reduce the human efforts and save time and drudgery involved in farm operations. By the use of these implements farmers ensure timeliness in farm operations, enhance the effectiveness of farm inputs, and make farming cost effective. Manual operated farm implements are beneficial and cost effective for marginal and small farmers of India. These implements save the time of operation, increase profit and reduce the drudgery involved in farm operations.

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Major Insect-Pests of Sugarcane and their Management

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INTRODUCTION

Termite, *Odontotermes obesus* (Termitidae: Isoptera)

Identification: Creamy colored tiny insects resembling ants with dark colored head live in mound.

Nature of damage:-Termite infestation occurs soon after planting when germinating setts and young shoots are affected. Newly planted setts suffer the most serious damage as termites enter through their cut ends or through the buds and feed on soft tissues replacing them with soil. The infested stools or shoots dry up soon after germination and these can be pulled out easily. Such shoots show no compensatory tillering. Occasionally 40-60% of the eye buds are destroyed leading to poor germination, gaps in the field and subsequent yield loss. In the ratoons, infestation occurs through the cut ends of the stubbles. In tillers, termites feed on the inner tissues of underground portion of the stem and filling them with soil.

Management: (1) **February-March**: At sowing time setts are treated with 2.5 L chloropyriphos 20 EC or 600 ml fipronil 5 EC (Reagent) (for sandy soil 700 ml) in 600-1000 L water or 150 ml Imidachloprid 200 SL in 250-300 L water and spray on the furrow with the help of knapsack sprayer.

(2) In the month of May-June apply irrigation at 10 days intervals to protect the crop from these insects.

Early shoot borer: *Chilo infuscatellus* (Pyralidae: Lepidoptera)

Identification: Adult moth is straw colored and laid eggs in the clusters of 10-30 eggs under the surface of the leaves by the side of the mid rib. The eggs are creamy-white in colour and has scale like appearance. The larvae are dull white in colour with a number of brownish-red longitudinal stripes on the back and they bore a number of times, either in the same stalk or in the neighboring ones. The larval period lasts for about three weeks, after which the larvae pupates in the tunnel within the sugarcane stalk where they had been feeding before.

Nature of damage: The plants, which are attacked by this pest, produce dead hearts from April to June and completely dry up. A loss of 10-20 per cent of young shoots is not uncommon during this period and in years of serious infestation; it may be as high as 70 per cent. After the formation of canes, the attack does not produce dead- hearts and the damage is confined to a few internodes only. Even then, there is considerable reduction in cane yield and sugar content.

Management: (1) February-March: At the time of sowing setts are treated with 2.5 L chloropyriphos 20 EC or 600 ml fipronil 5 EC (Reagent) (for sandy soil 700 ml) in 600-1000 L water per acre spray on the furrow with the help of knapsack sprayer or use 150 ml Imidacloprid 200 SL in 250-300 L water or 8 kg Dursban 10G / 10 kg fipronil 0.3 G / 7.5 kg Sevidol 4G per acre.

(2) April- June: When the soil testing is not done at the time of sowing, treat the setts with above any one insecticide. Irrigate the field in the month of May-June at 10 days intervals to protect the crop.

Top shoot borer, *Scripophaga excerptalis* (Pyralidae: Lepidoptera)

Identification: Damaged is caused by caterpillars which are generally found in the top portion of a cane. Caterpillars are creamy white in colour and sluggish. The moths are pure white in colour and carry a reddish tuff of silken hairs at the tip of its abdomen.

Nature of damage: The first two broods of this pest attacks on young plants before the formation of the canes and infested plants started dying. In subsequent broods, the pest attacks the terminal portion of the canes, causing bunchy tops. Damage by the third and fourth broods may result in more than 25 per cent reduction in weight and a decrease in the quality of juice.

Management: April-October: In the month of April to June cut the sugarcane plant from the root, burry them and also destroy the egg mass. April to first week of may spray in the roots 150 ml chloropyriphos 20 EC in 400 L water per acre and do light irrigation after that. If top borer attack is more than 15% in the end of June, apply 13 kg carbofuran 3G or 8kg phorate 10G along the row. If in the month of May insect infestation is up-to 5% than use any above insecticide for better management.

Root borer, *Emmalocera depresella* (Pyralidae: Lepidoptera)

Identification: Fully grown caterpillars are milky white in colour. Caterpillar does not eat roots but they make the hole on upper surface of root.

Nature of damage: This pest is primarily destructive to young plants and the attack is particularly severe from April to June. Plants attacked after the formation of canes are not killed, although and sugar content is reduced.

Management: Release of egg parasitoid, *Trichogramma chilonis* @ 50, 000/ha at 10 days interval. Spray the crop with Imidacloprid 200 SL in 250-300 L water on the furrow with the help of knapsack sprayer.

Stalk borer, *Chilo auricillus* (Pyralidae: Lepidoptera)

Nature of damage: In spring, when the pest first appears on the ratoon crop, the late "water-shoots" play an important role in multiplication of insect. By the time the canes are formed in August- September, 75 per cent of them may be infested, the heavily manured fields and soft varieties suffering more. The lodged crop and waterlogged fields are also more severely infested. The caterpillars have the habit of boring into on internode after another and moving from plants to plants. On an average, it causes 16 per cent reduction in cane yield.

Black bug, *Cavelerius excavates* (Hemiptera: Lygaeidae)

Nature of damage: On young plants, the nymphs and adult suck cell-sap from the central whorl. On the grown-up plants, they prefer to feed within the leaf sheath and varieties having broad and loosely attached sheaths are preferred by this pest. The attacked leaves become paler and also show holes after feeding.

Pyrilla or Sugarcane Leafhopper, *Pyrilla perpusilla* (Hemiptera: Fulgoridae)

Identification: The leaf hopper is very agile and jumps around in large numbers, making a faint noise when a person walks through a heavily infested field. The adult equally active has a straw colored body with dark patches or spots on the wings. At the front end it has a snout like prolongation and prominent red eyes.

Nature of damage: Succulent varieties of sugarcane with broad leaves are preferred by this pest but when it occurs in abundance, no variety is spared. Owing to the loss of cell-sap, the leaves turn pale yellow and shrivel up later. Even the canes dry up and die when the attack is very severe. The insects excrete a thick transparent liquid, known as honeydew which falls on the leaves and makes a good medium for the growth of a black mould. Therefore, in time, the leaves acquire a sticky black appearance and the attacked crop can be spotted from a distance. The black coating interferes with photosynthesis and very less food is prepared by plants. The existing sugarcane sucrose in the canes is also used up and about 35 per cent reduction in sugar yield is not uncommon.

Management: (1) Sometimes leafhopper will be attacked in April to June. To control this pest spray 400 ml malathion 50 EC in 400 L water per acre.

(2) July- November: Sugarcane leafhopper becomes very destructive due to changing environment. But at that mean time egg parasitoid also present in the field. These egg parasitoid to grow inner side of the leafhopper egg. Due to this egg colour changes and become brown, pink or black and they control itself. These parasitoids are reared in biocontrol laboratory located at Sonipat, Shahabad, Meham and Jind sugar mills. If these are not controlled by parasitoid than spray with 400-600 ml Malathion 50 EC in 400- 600 L water per acre.

Whitefly, *Aleurolobus barodensis* (Hemiptera: Aleyrodidae)

Identification: Nymph of the whitefly is oval, black in color and has a silvery grey waxy coating on the body. The adults are small delicate, pale yellow and their wings have a white mealy appearance, molted with black dots. They flutter about briskly, but they are not easily noticed in the field.

Nature of damage- Only the nymphs cause the damage by sucking the cell-sap. Yellow streaks appear on the attacked leaves and the crop acquires a palish-green appearance. The general vitality of the plants is reduced and the quality and quantity of *gur* production is poor because of subnormal crystallization of sugar. Sugar recovery is reduced by about 15-25 per cent. A black moulds on the honeydew excreted by the pest and it interferes with proper functioning of the leaves and renders them unfit as fodder. A comparatively poor crop with a thin stand is attacked more readily than a well- manured and heavy crop.

Management: July-November:- Use 800ml of malathion 50 EC or methyl demeton 25 EC (Metasystox) or 600 ml dimethoate 30 EC for spray in 400 ml water per acre. In this solution add 10 Kg urea for greening the leaves frequently.

Mealy-bug, *Saccharicocus sacchari* (Hemiptera: Coccidae)

Natures of damage- Mealy-bugs are first noticed in appreciable numbers when canes are four month older and from then on, they remain on the plants till harvest. Canes having tight-fitting sheaths are more or less free from attack, whereas a drought- affected crop is more severely damaged. The bugs drain away large amount of sap from the canes and befoul them by their mealy secretions and honeydew. A sooty mould develops on these secretions giving a blackish appearance to the canes. It is also suspected that the mottling disease of sugarcane which is serious in certain parts of India is transmitted by these bugs.

Mite, *Oligonychus indicus* (Acarina: Tetranychidae)

Natures of damage- The mite feeds on plant and suck the sap with its stylets. The male insects feed rarely and the damage is done mainly by the female insects and their nymphs.

As a result of their feeding, the leaves turn red and gradually dry up. Sugarcane varieties with soft leaves are attacked more readily and damage is noticed to the greater extent during the pre-monsoon period.

Scale Insect

Identification: The adult female is sedentary having no legs or wings and lives inside a white covering or a white scale. The male is minute and free living. It has special sharp organ to penetrate the female scale covering.

Symptoms: Water logging, high temperature and humidity favor buildup of scale insect population. It spreads to new areas through seed material. Scales usually establish on internodes covered with leaf sheath. The leaves of infested canes show signs of tip drying and unhealthy pale green colour and with continued infestation turn yellow. Desapping leads to non-opening of leaves turn yellow and finally dry up. Nodal region is more infested than intermodal region. Infested crop growth is stunted and the internodal length is reduced drastically.

Management: This insect found only in Sonipat and Faridabad districts and affects the lower portion of sugarcane.

Following practices should be used during December to March:

In the scale affected area pest act become effective. Do not take seed from affected area to unaffected area. For sowing to take healthy setts or if use these infected seed than dip with 0.1 per cent of 20 ml malathion 50 EC + 10 L water for 20 minutes. Do not give permission to grow rationing crop. Burn the crop residue after harvesting. At the lower portion of sugarcane to separate the leaves 2-3 times-when insect infestation start and when crop become 6 -8 month old.

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Mat Type Nursery Raising Technique for Rice Transplanters

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INTRODUCTION

The rapid increase in labour cost and to ensure timeliness in farm operation mechanization of traditional method of rice transplanting is need of the hour. There is shorter window period for rice transplanting, farmers are facing difficulty in timely paddy transplanting. Traditional way of rice transplanting is labor intensive and involves drudgery. Mechanical rice transplanter is Cost effective and operation friendly. It helps in maintaining soil physical properties and is considered to be better from crop management and productivity point of view. Raising mat type nursery in frames or in fields is complex and labor intensive technique and possibly one of the major constraints in adoption of mechanical transplanting. Sometimes the plant population in nursery is uneven which may affect the performance of the transplanter. In spite of having an edge over the traditional transplanting, adoption rate of mechanical transplanters is low due to lack of knowledge in growing mat type nursery (Guru et al., 2018). This article provides procedure and guideline for preparation of mat type nursery for rice transplanter.

Preparation of Mat type nursery:

For manual transplanting of rice, nursery was prepared in field and for mechanical transplanting, mat type nursery was prepared using seedling tray or seedling frame in field. Proper care until the transplanting has been done. For manual transplanting of 1 hectare land, 800 m^2 area was required for nursery preparation (Patel et al., 2018). Assured water supply and efficient drainage system is needed for good quality rice nursery. Select the mat type nursery location having fertile soil preferably medium type where irrigation water is available and minimum transportation distance of seedlings to the field.

The field should be 20 m away from tubewell and trees to avoid shade, debris and damage by birds. For nursery preparation selected area of field should be ploughed twice followed by two puddlings in weekly interval and levelled by available power source i.e. animals, power tiller or tractor preferably using laser guided land leveller. There should be no stones or other hard material in the soil mixture. After preparation of land spread 50-60 gauge, 90 cm wide polythene sheet with 1-2 mm diameter perforations over it. Place one or more iron frames having compartments of size 18x9.5x0.75 inch for Self-propelled single wheel riding type transplanter, 18x12x.0.75 inch for self-propelled walk behind type paddy transplanter and self-propelled 4 wheel type paddy transplanter over the polythene sheet. Number and size of compartments vary according to machine specifications. Sprouted seeds were uniformly spread over the surface and in 20-25 DAS seedlings were pulled out for transplanting. Polythene sheet weighing 350 gms spread to a length of about 20 meters is sufficient for preparing seedlings for one acre. Fill the soil from both sides in the frames uniformly up to the top surface. About 10-12 kg seed is sufficient to sow seedlings for one acre Spread pre-germinated seed evenly in each compartment to achieve uniform density of 2-3 seeds per sq. cm. Cover the seeds by a thin layer of soil and sprinkle water by hand sprayer for proper setting of soil. Lift frames and put these at the next place and repeat the above procedure for sowing required number of seedling mats. After sowing, irrigate the field, but the flow of water for first 2-3 irrigations should be mild and level should be uniform so that there is no damage to newly formed mats. Care must be taken that mats are always wet. The seedling mats become ready after 20-25 days of sowing. For uprooting seedling mats, drain the water from the nursery field a few hours before uprooting and give a cut with a sharp blade along the boundaries the mat. For mat type nursery seedlings are established in a layer of soil mix, arranged on a firm surface i.e. Concrete floor/ polythene sheets on field/ seedling trays. Seedlings are ready for planting within 14-20 days after seeding (DAS). For uprooting the seedling mat, give a cut with a sharp blade along the boundaries of the mat.

Fig. 1: Mat type nursery

Figure 2Mechanical rice transplanter in operation

CONCLUSION

Imparting technical knowledge, ensuring timely availability and encouraging custom hiring may be some of the practical solutions for increasing the rice area under mechanical transplanting. Mechanical transplanting is fast and efficient uses less labor and ensures timely planting. Mechnical transplanting reduces stress, work load, and health risks as compare to the the manual transplanting. It also ensures uniform spacing and plant density and seedlings recover fast, tiller vigorously, and mature uniformly.

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Modernization & Up Gradation of Rice Mills through Cost Effective Technology

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INTRODUCTION

Rice milling is the oldest and the largest agro processing industry of the country. At present it has a turnover of more than 25,500/- crore per annum. It processes about 85 million tonnes of paddy per year and provides staple food grain and other valuable products required by over 60% of the population. Paddy grain is milled either in raw condition or after par-boiling, mostly by single hullers of which over 82,000 are registered in the country. Apart from it there are also a large number of unregistered single hulling units in the country. A good number (60 %) of these are also linked with par-boiling units and sun -drying yards. Most of the tiny hullers of about 250-300 kg/h capacities are employed for custom milling of paddy (NABARD, knowledge bank). Apart from it double hulling units number over 2,600 units, underrun disc shellers cum cone polishers numbering 5,000 units and rubber roll shellers cum friction polishers numbering over 10,000 units are also present in the country. Further over the years there has been a steady growth of improved rice mills in the country. Most of these have capacities ranging from 2 tonnes /h to 10 tonnes/ h.

Description of Rice Milling Operation:

After harvesting of Paddy, it is in raw form and cannot be consumed by humans before necessary processing for obtaining rice. Rice milling is the process followed to remove hulls and barns from paddy grains to produce eatable polished rice. The basic rice milling processes after harvesting are as follows:

Drying	:	To get optimum moisture level before milling
Pre Cleaning	:	Removing all impurities (big stones, soil particle) and unfilled grains from paddy
De-stoning	:	Separating small stones from paddy
Parboiling (Optional)	:	To improve the nutritional quality by gelatinization of starch inside the rice grain. It improves the milling recovery percent during deshelling and polishing / whitening operation
Husking	:	Removing husk from paddy
Husk Aspiration	:	Separating the husk from brown rice/ unhusked paddy
Paddy Separation	:	Separating the unhusked paddy from brown rice
Whitening	:	Removing all or part of the bran layer and germ from brown rice
Polishing	:	Improving the appearance of milled rice by removing the remaining bran particles and by polishing the exterior of the milled kernel
Length Grading	:	Separating small and large brokens from head rice
Blending	:	Mixing head rice with predetermined amount of brokens, as required by the customer
Weighing and bagging	:	Preparing the milled rice for transport to the customer

Rice mills can be widely divided in two groups to serve local and international market

1. **Rice mills to serve local market**

- Performance parameters are head rice yield and operating cost
- Indian companies making small & large mills to fulfil the domestic need

2. **Rice mills to serve export market**

- Performance parameters are capacity, utility and appearance
- Many foreign companies are concentrating on manufacturing of highly sophisticated rice mills for producing export quality rice

Traditional rice mill

- Whole grain recovery is less
- Excessive loss in the form of coarse and fine broken
- No paddy dryer used before milling to obtain uniform and suitable moisture limit of grains results in production of inconsistent qualities of rice
- Final product transferred manually add dust particle which deteriorate the quality of rice and increase the moisture content results in less shelf life of rice
- Loss of large portion of endosperm layers
- The machines were non-commercial as the output quality was low
- Use of traditional and locally produced non-standard fabricated items used for milling operation
- Mild steel usage in rice mill machineries and corrosion of mild steel affected the rice quality
- Quality management systems were not employed. There were no testing labs for routine check-ups.
- By product recovery is difficult because of absence of aspiration system
- No proper utilization of by-products of rice
- There wasn't enough investment to buy modern rice mill machinery (automatic and semi-automatic) manufactured and supplied by Japan & Germany.
- It has also been observed that the location of rice mills are confined to a few selected production centres. Their development as a village level agro processing unit is yet to take a proper shape. In the absence of village level rice milling unit, the farmers have to travel great distances for milling the rice. This leads to increased transportation and handling losses.

Modernization and Up gradation of rice mills

Rice mills must modernize to meet global quality standards to meet out the domestic and international demand. Some new technologies need to be popularized in today's milling machines are:

- Modern rice mill having capacity upto 150-330 T/day
- Modern destoner technology completely removes all the impurities of rice
- Pneumatic rubber roll sheller technology decrease 2-3 % broken rice as compare to traditional huller
- Colour shorter technology removes all impurities from rice i.e. black rice, chalky grain, and paddy if any
- Old stone disk hullers, vertical cone polishers have been replaced by emery-coated cylinders, friction-type whitener polisher, and dry & wet mist polishers

- Two-stage whitening process
- Milled rice is now graded
- Equipped with packaging machine results in high quality rice grains with more cleanliness and more shelf life
- Equipped with complete safety for electrical connections provides more comfort to operators
- Skilled operators, good paddy quality, maintenance of machines set the tone for high-quality outputs
- Finish product evenness, silkiness, good appearance with higher shelf life
- Bran oil is one of the healthiest by-product of rice, full recovery add extra income to miller
- Hygiene in rice processing
- Optimum utilization of capacity man-machine-system. If the capacity of rice mill is more it is more economical viable to run
- Automated plants from Germany & Japan are the new market trends

Up-gradation of rice mill by adopting modern processing technology

1. **Soft drying for high moisture paddy** (Patil & Singh, 2008)

- Soft drying of paddy is quite a new concept in which moisture transfer takes place from raw paddy to dry husk utilizing dry husk's hygroscopic character without heat stress under normal temperature.
- The running cost of soft drying is low because no heat is required, only aeration is done using high capacity blowers.
- The process provides higher head yield because there is no heat stress to grain as in sun drying or mechanical drying.
- There is no cracking of grain during the process. It is energy saving technique because of no heavy mixing of paddy during drying.
- The drying of moistened paddy is relatively simple as there is no quality concern.
- In the process, dry husks are likely to absorb moisture from raw paddy. Gradually, moisture contents of higher and lower get balanced.

2. **Bio polishing** (Patil & Singh, 2008)

- Bio-polishing of the rice is done with some selected multi-enzymes having the catalytic properties to degrade the bran layer of rice. The enzymes are the selective biocatalysts, which are very specific to their targeted reactants. Thus through such processes the amount of by-product yield is minimum.
- The salient features of bio-polishing are no loss in head rice yield, nutrient rich than milled rice, fibre content more than milled rice, with benefits of germinated brown rice, softer with less cooking time than brown rice, enzyme treated rice has been found to have better shelf-life as compared to the non-treated rice, enzymatically treated rice possessed higher antioxidant potential, free amino acids, crude fibre and phenolics as compared to the non-treated rice.
- There are many benefits of bio-polishing, such as mechanical damage to rice kernel can be avoided, parboiling process can be skipped, nutrient loss or weight loss can be avoided, selective bio-polishing has helped to retain the mineral with minor losses in Magnesium, Iron and Zinc, while Calcium content increased by 10%, enzymatic treatment exhibited more positive effect on water uptake ratio and volume expansion ratio, less cooking time, and easier for digestion.

3. **Pnumatic rubber roll sheller technology**

- Dehusking using rubber roll shellers reduces the risk of breaking the grain because husk is pulled off almost at once and pressure is applied by means of resilient surfaces across the width of the grain, where kernels, generally are much more uniform than they are by length.
- The process does not remove the internal epidermis of the husk. Thus the deshelled grains with their silver skin envelope are protected against scratches and keep longer and better while the silver skin and the germ increases the quantity of bran which is produced while whitening.
- The improved rice mills have a better husk and rice bran aspiration system. The same prevents mixing of fine brokens with rice bran. Therefore the quality of rice bran obtained is better.

4. **Energy saving technology** (Goel et al., 2014)

- Paddy cleaner blower operates throughout the year and hence its system efficiency should be analysed and improved
- The hot water after soaking may be wasted as a drain that represents enthalpy loss
- The system efficiency of the de-husker, pre-cleaner, dryer blowers should be site specific
- The polishers are having high rated motors. A motor load survey should be carried out.

Modern rice mill features

1. **Pre cleaner**

- High separating efficiency.
- Easy alignment of motor with adjustable sieves
- Robust construction with low maintenance requirements.

2. **Destoner**

- No loss of grains with easy discharge of stones
- Very Low Maintenance with permanent lubrication and easy access to sieves for cleaning or replacement
- Compact design requires less installation space. In place of pulleys, belts, eccentric bearings, etc vibratory drive can be used.

3. **Husker**

- Advantages of decreased breakage, greater aspiration efficiency and significantly improved rubber roll life.

4. **Paddy separator**

- Constant and stable separating performance.
- Compact design and large capacity to minimize installation space.
- Special outlets for rice inspection of quality and flow
- Easy Flow Adjustment

5. **Rice whitener**

- Gentle milling of brown rice over a larger milling surface to ensure a greater Whiteness in a process
- Quicker removal of bran from the screens to improve performance of screens in a continuous operation
- Maintain temperature during milling operation
- This retains the good characteristics of rice while it is milled gently
- Fully automatic plant to maintain quality of produce with minimum human energy expenditure

6. **Rice polisher**

- The surface of milled rice should be smooth and clean to enhance commercial value.
- Removal of residual bran to gives rice a longer shelf life
- Milling rolls and screens are chosen to minimize breakage of rice kernels
- Suitable of wide varieties of rice

7. **Rotary shifter**

- Shifting of milled rice efficiently and accurately into 5 to 7 classes: large broken, medium broken, small broken, tips, bran, etc.
- Wide Choice of Sieve Combinations
- Completely Sealed Sieve Frame to prevent dust from escaping the machine, which ensures clean operation and improves plant sanitation.

8. **Length grader**

- Length graders are indispensable for producing high quality products in rice milling and seed cleaning plants, since the broken or shorter grains that are more than half the length of whole grain are difficult to separate through sieving or thickness / width grading.
- The grains which are longer in length drop out of the indents before they reach the catch trough.

9. **Colour Sorter**

- Higher Quality Sorting of grains removes all impurities from rice i.e. black rice, chalky grain, and paddy if any
- Simple sorting control makes it easy for operator to achieve maximum sorting performance with minimum training

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Impact of Covid-19 on Indian Economy

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INTRODUCTION

Coronavirus disease 2019 (Covid-19) has badly impacted the economic activities as well as human lives all over the world. The year 2020 has witnessed unrivalled turmoil of novel covid-19 virus and the exponential rise in corona virus cases compelled World Health Organization (WHO) to title this outbreak a pandemic on 11th march, 2020. The economic impact of corona virus pandemic in India has largely been disruptive. It has brought social and economic life at a standstill leading to a steep fall in output i.e. minus 24.4% during first quarter of 2020. Majority of the sectors have been hit hard as domestic demand and exports plummeted sharply. Thousands of micro, small and medium enterprises have shut down leading to job loss of masses.

Notably India has been witnessing a pre-pandemic slowdown as India's GDP growth rate was 8.26% in 2016-17 and had fallen to 4.18% in 2019-20. This was due to contraction of consumption and investment demand. Furthermore, the pandemic has intensified the pre-existing risk of economic downturn to new heights as it has triggered twin economic shocks i.e. both demand and supply side shocks simultaneously. The demand side shock involves reduced investment due to increase in future uncertainty, lack of effective demand for non-essentials, reduction in consumption due to income loss, etc. while the supply side shocks involves unavailability of labour for production due to their restricted movements, closure of economic activity due to nationwide lockdown during April-May, 2020.

The effect of covid-19 on agriculture sector was likely to be low as it was largely insulated from the countrywide lockdown due to its essential nature. This facilitated uninterrupted harvesting of rabi crops and sowing of kharif crops during the year 2020. The continued unabated procurement of foodgrains enhanced the buffers and ensured food security throughout the year.

However, a significant impact was seen on the transportation of agricultural goods thus leading to high food inflation and adverse initial impact on some major agricultural exports. Further, a large number of farmers who grew perishables also faced difficulty amidst lokdown. The impact can also be seen on allied sectors. As per reports, sales of poultry sector reduced by 80% losing a business of nearly ₹ 1500-2000 crore daily. Overall, the sector performed well by showing a positive growth of 3.4% during both Q1 and Q2 and 3.9% during Q3 of FY 2020-21.

The manufacturing sector was hit hard due to pandemic induced lockdowns as it showed a negative growth of 39.3% during Q1 of FY 2020-21. Millions of people lost their jobs due to the shutdown of small scale industries and new MSMEs. The nationwide lockdown led to reverse migration of workers from cities to villages and it was estimated that around 6 lakh workers walked on foot and 10 lakh workers were in relief camps, who were employed across multiple sectors. Moreover, work from home culture reduced the scale of operation thus affecting the quality, cost and production volumes of the commodities. The uncertainties in the logistics, reduced demand of transport fuels, and the lack of effective demand due to disengagement of consumers from buying processes by postponing the non-essential purchases leads to adverse effect to the manufacturing sector during the pandemic. Major companies, young startups and fast moving consumers goods companies have reduced their operations. It was reported that the construction related GVA and employment reduced between 15 to 34 per cent and 11 to 25 per cent respectively when compared to pre-crisis projections for FY21.

In terms of employment shock, contact sensitive sectors like trade, hotel, transport, tourism, etc. experienced a shock proportional to the respective employment share, with informal workers bearing a larger brunt. The service sector was abysmally hit hard among all sectors as it reported a negative growth rate in all three quarters i.e. -47% (Q1), -15.6% (Q2) and -7.7% (Q3) of FY 2020-21. As per reports, there was 20% reduction in domestic travel and about 75% reduction in international travel bookings. Hotel booking rates have also declined from 70% to 20%. According to IATO (Indian Association of Tour Operators) estimates, the hotel, aviation and tourism sector might have incurred a loss of about US $85 billion due to travel restrictions. Restaurant business was down by 30-35% during the last year. The imports of electronics from china dropped from 55% to 40% due to the pandemic. The lockdown has also resulted in reduced exports of raw materials like organic chemicals, cotton, minerals fuels resulting in substantial trade deficit for India. The pharmaceutical industry has been on the rise since the start of this turmoil. With a market cap of US $55 billion at the start of 2020, it has been surging in India, exporting recently launched Covaxin and Covishield vaccines along with other generic drugs.

A massive impact on India's economy due to nationwide lockdown was increase in unemployment to 23.52% in April 2020 and caused a GVA loss of more than nine percent during that month. During the lockdown, an estimated 14 crores people lost employment while a large number of people reported huge salary cuts and more than 45% of the households have perceived drop in income as compared to the previous year. Under complete lockdown, less than a quarter of India's $2.8 trillion economic movement was functional and approximately 53% of businesses in the country were projected to be significantly affected. The revised GDP figures for Q1 (-24.4%) and Q2 (-7.3%) during FY 2020-21 were worrisome indicating a formal entry of Indian economy into technical recession. However, the GDP for Q3 came out to be positive i.e. 0.4% which indicates a ray of hope under uncertain and gloomy economic situation. Furthermore, the MoF (Ministry of Finance) predicts a V-shaped recovery of economic activity. The economic stimulus package of ₹ 20 lakh crore worth 10% of India's GDP announced by Union government

also helped in enhancing the effective demand and carrying out essential constructional and developmental work at a large scale.

The V-shaped recovery can be attainable if recent national vaccination drive of Covaxin and Covishield vaccines become available to all sections of the society as it will determine the pace of economic recovery. Furthermore, the extent and effectiveness of government's policy stimulus measures will determine the economic revival, as nation is preparing itself to move towards a new normal. Moreover, the recovery in demand aspects from consumer's side will prove to be a positive sign of opening up of economy. At last but not the least, by adopting new principles like shift towards localization, focus on building of self reliant nation, supply chain resilience and novel innovations will prove to be a new path of recovery in this uncertain situation.

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Crop Residue: Management Option and Competing Use

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INTRODUCTION

Crop residues are important natural resources and their recycling is a major challenge. India is an agricultural country produces annually massive quantity of plant residues. Generally, residues are left portion of the plants after harvesting and threshing. They also called as waste materials that disposed but increasing realization of their importance, they are precious nature resources and not as waste products. Recycling of them into useful output/product is needed for meeting nutritional requirement of field crops. It helpful in maintaining physical, chemical and biological properties of soil and recovers ecological balance of the production system. A large percentage of residues are burnt by farmers to clear field after harvesting for timely sowing of succeeding crops. Labour shortage, high cost of its removal and mechanized harvesting of crops are central reasons for burning of crop residues. Crop residues burning causes pollution, health issues, declining soil fertility, and GHG emissions. Therefore, there is need of suitable management of crop residues in the field conditions. Conservation based system (CBS) of residue are more efficient than the conventional practices (CP).

Reasons behind on-farm burning of crop residues

Farmers know about the adverse effects of on-farm burning of residues. But, increased mechanization (combine harvesters), declining livestock's populations, long time period for composting and no alternative which is economical So, farmers had only option to burn the residues. The combine harvesters in the country particularly in IGP has increased from 2000 in year 1986 to over 10000 in year 2010. Punjab, Haryana and Uttar Pradesh of the IGP have about 75 percent area under combine harvesting. Major reasons for increase in the use of mechanized harvesting are high wages (harvesting season), labour shortage and uncertainty of weather. After using combine harvester, nearly about 80 percent of the residues are left in the field as loose straw which ends up by burnt on farm.

Burning on farm provides easy and fast way to clear the fields that requires for land preparation and sowing of succeeding crop.

The time gap in between rice harvesting and wheat crop sowing is only 15-20 days. Therefore, in this short time, farmers prefer to burn the all residue.

Competing uses of crop residues

1. Livestock feed 2. Compost making 3. Energy source 4. Bio-fuel production 5. Bio-methanation
6. Gasification 7. Biochar production

Crop residues management strategies/option

Indian agriculture is facing various challenges/problems viz; stagnating of net sown area, climate change effect, deterioration of land quality and reduction in per capita land availability. The Major reason for degradation of agricultural land is low soil C content. Management of crop residues with conservation agriculture (CA) is necessary for sustainability of our Indian agriculture. Hence, burning of residues need to reduce and utilized them in improving soil health and also reduce environmental pollution. Several technologies/expertise are available for proper use of crop residues in CA. There is need for large scale adoption by low-skilled farmers. Conservation agriculture is a viable option for crop residue management.

- Minimizing soil disturbance
- Seeding of crop seed directly into soil
- Enhancing organic matter cover on soil using cover crops
- Diversification of crops

CA-based resource conserving technologies are laser land leveler, zero tillage, DSR, crop diversification and raised bed planting All technologies help in improve organic C, enhance input efficiency and reduce GHGs emissions. Sowing of a crop in the residues of preceding crop (rice) is a major problem which can solves by using turbo happy seeder (THS), for direct sowing of seeds in the residues. These machines are also helps in conserving nutrients and moisture, controlling weeds and soil temperature regulation. Following point should keep in mind for management of crop residues.

1. Development of inventories of crop residue which area regional specific.
2. Satellite images collected for estimate the amount of residues burnt.
3. Assessment of the quality of crop residues and their suitability for off and on farm uses.
4. Developing simulation models for prediction of impact of conservation agriculture.
5. Enhancing rate of decomposition of residues for in-situ incorporation of residue.
6. Assessment of life-cycle of residue-based CA through comparing with conventional method of disposing residues
7. Optimizing residues use as source of fodder for livestock system
8. Assessment of residue retention/ incorporation suitability in different soil and climatic conditions.
9. Development of appropriate farm machine for collection, transportation and use of crop residues as mulch on soil surface.
10. Modifying combine harvester to chop, carries and deposit crop residues in the field during sowing.
11. Developing and implementing legislation on prevention and monitoring of on-farm crop residues burnings through punishment.
12. Developing the residues management policy for each state for its various uses.
13. Supplying machineries for CA on subsidy rates, promotes customer hiring services and loans for purchase of implements.
14. Introducing carbon credit schemes to benefit the farmers who follow CA for C sequestration and GHGs mitigation.
15. Add CA component in soil health card for best monitoring of crop residues burning and its effects on soil health.

16. Use crop residues as amendments and their use in agriculture like fertilizer or amendment.
17. Analyzing the socio-economic factor, benefit cost ratio, and technical feasibility of on and off farm residue uses.

1) Rice Residue Burning in the field

2) Sowing of wheat with Happy Seeder in Rice residue

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Identification of Important Diseases of Wheat

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INTRODUCTION

Wheat is one of the important staple foods worldwide. Significant gains wheat production over the past 40 years has resulted in a steady balance between supply and demand. On the other hand, predict global growth in population rates and dietary changes gives an idea about to increase production in upcoming decades to meet this escalating demand. The essential component to overcome this challenge is better and appropriate management of fungal diseases, which is responsible for 15–20 percent yield reduction per year. The major diseases of wheat that contribute most to these losses are rusts, smut and the bunts. Other recently emerges or unnoticed diseases viz; wheat blast and spot blotch also threaten wheat production. The most important wheat diseases and their symptoms caused by these diseases are present below.

1. Loose Smut (*Ustilago tritici* (Pers.) E. Rostr.)- The normal head tissue of plants infected by this disease is completely replaced with the dark masses of fungal spores and giving the heads a black powdery appearance. It is possible to notice the heads damage by loose smut while much of the head is still inside the boot. Only central stem of the head is left over after the spore's release. Maximum Spores are washing and blown away by wind and rain and at harvest only bare spike remains. It is seed-borne disease of wheat kernel and it can be controlled by treating the wheat seed with various fungicides before planting.



2. Leaf Rust (*Puccinia recondita* f. sp. tritici Eriks. & Henn)- Small, orangish-brown lesions are key features of leaf rust infections. These blister lesions are very common on leaves but can also appear on the leaf sheath. Lesions caused by leaf rust are smaller, more round in shape, and cause less tearing of the leaf tissues than those caused by stem rust in wheat. It is transmitted to other plant by wind borne fungus spores. Foliar spray of fungicides is effective in controlling this disease.

3. Stripe Rust/ Yellow Rust (*Puccinia striiformis* var. striiformis Westend**)-**Stripe rust causes yellow, blister-like lesions that are arranged in stripes. The disease is most common on leaves, but head tissue also can develop symptoms when disease is severe. Outside the United States, this disease is sometimes referred to as yellow rust. Genetic resistance, foliar fungicides are effective in controlling stripe rust.

4. Stem Rust (*Puccinia graminis f. sp. tritici*)- Stem rust causes blister-like lesions on leaves, leaf sheaths, and stems. Infection of glumes and awns is also possible. The reddish-brown spores of the fungus cause considerable tearing as they burst through the outer layers of the plant tissues. Mature stem rust lesions are more elongated than those of leaf rust. Genetic resistance, foliar fungicides are effective in controlling stem rust.

5. Karnal Bunt (*Neovossia indica***)-**Karnal bunt is mainly a disease related to grains. Either in partially or fully infected condition the whole grain is converted into black powder of bunt spores. In highly infected spikelets, bunted grains form a greater angle with the main axis and may fall to the ground. At the beginning, the smut sorus is covered with a membrane (pericarp) which, when it bursts, releases black masses of spores that contribute to the bunt smell. The fungus produces chemicals with a fishy odor, which sometimes causes this disease to be referred to as "stinking smut." The spores may disperse with air or may fall to the ground and thus the inoculums is not limited to only fields but can spread to distant places. The measures to control Karnal bunt in the field are Resistant varieties, Seed treatment with fungicides, Crop rotation, Controlled irrigation etc.


6. Blast (*Magnaporthe grisea* (anamorph *Pyricularia grisea*)- Symptoms are visible on all plant parts. A seedling infection can result in plant death. Foliar symptoms on young leaves are elliptical lesions which vary in shape and size on older leaves. The centres are whitish to light brown with reddish-brown to dark grey margins. On the lower side of the leaf the lesions are dark grey due to sporulation. The awns can have brown to whitish discolourations. The spikes are straw-coloured. Depending on the growth stage at which infection takes place, the kernel formation can be zero to normal. Kernels of diseased plants are smaller, lighter and shrivelled and are of low quality. *Pyricularia grisea* is an air- and seed-borne disease. Seeds, grasses, volunteer plants and plant debris can be sources of inoculum. Fungicides that provide complete control have not been discovered so far. Some strobilurins and triazoles can be applied during heading, but they provide no control in susceptible cultivars.


7. Powdery mildew (*Blumeria graminis* f. sp. tritici) - Powdery mildew causes white lesions on leaf sheaths and leaves. When disease is severe, glumes and awns can also be infected. Fungal growth is limited to outer plant surfaces and easily wiped away by rubbing the finger across the affected areas. Mature lesions may have dark and reproductive structures mixed with the white and cottony growth of the fungus. Disease can be both stubble borne

and carried over on green bridge, so management strategies include controlling volunteer wheat, crop rotation to avoid stubble borne infection and using foliar fungicides.

8. Flag Smut of Wheat (*Urocystis tritici***)-** This flag smut disease mainly affects the leaf of the wheat. The greyish black linear sori occur on sheath and leaf blades in between the veins. In the early stage, the sori are cover with epidermis and later it ruptures and exposing the black spore mass. The infected plant of wheat shows stunting growth, leaves twisting and ultimately results in no ear head formation. Grow resistant varieties, use certified seeds, field sanitation, avoid late sowing of crop, rogue out the affected plants and destroy by burning are the best management expertise in controlling it.

CONCLUSION

It is, without question, the case that diseases of wheat provide a significant challenge to maximize the wheat yields, now and into the future. In this article, we have attempted to briefly summarize the identification of some of the most significant wheat diseases with symptoms photos currently threatening production. We acknowledge that there are many other diseases that also threaten production (e.g. Wheat Streak Mosaic, take-all, bare patch, eyespot, crown rot etc); however, space limitations restricted our selection of diseases to currently considered to have the greatest effect on yield. Although clearly not exhaustive, this article provides a reference point for colleagues, farmers and plant pathology students to appreciate the complexity of these diseases and to consider them in a more holistic manner.

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Water Management in Indian Perspective

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INTRODUCTION

Distribution of water resources of India: Water is the most basic resource to sustain the life on earth. It is a natural resource, fundamental to life, livelihood, food security and sustainable development. India has more than17 percent of the world's population, but has only 4% of world's renewable water resources with 2.6% of world's land area. The total surface flow, including regenerating flow from groundwater and the flow from neighboring countries, is estimated at 1,869 cubic kilometers per year (km^3/year), of which only 690 Km^3 are considered as utilizable in view of the constraints of the present technology for water storage and inter-state issues. The Central Water Commission estimates the groundwater resources at 418.5 km^3/year. Part of this amount, estimated at 380 km^3/year, constitutes the base flow of the rivers. The total renewable water resources of India are therefore estimated at 1,907.8 km^3/year.

Water related disputes : With a growing population and rising needs of a fast developing nation, availability of water is coming under severe strain. Many international as well as intra national conflicts owe their origin to water sources. Baghlihar project, Kishanganga project etc. are often discussed in India Pakistan talks, sharing of water of Teesta River is discussed in India Bangladesh talks, and India is also concerned with China's plan to divert the water of Brahmaputra River. Within India also, states like Tamil Nadu and Karnataka, Punjab Haryana and Rajasthan comes at loggerhead for water sharing issues.

Significance of effective water management: Most of the water disputes are due to its unequal distribution and lack of a unified perspective in planning, management and use of water resources.

Large parts of India have already become water stressed due to rapid growth in demand for water due to population growth, urbanization and changing lifestyle pose serious challenges to water security.

The problem is more intensified due to wide variations in availability of water, which may increase substantially due to climate changes, causing more water crisis and incidences of water related disasters, i.e., floods, increased erosion and increased frequency of droughts etc. Climate change may also increase the sea levels. This may lead to salinity intrusion in ground water aquifers / surface waters and increased coastal inundation in coastal regions. Access to safe drinking water still continues to be a problem in some areas. Skewed availability of water between different regions and different people in the same regions is has the potential ofcausing social unrest.

Causes of water mismanagement: Inequitable exploitation of groundwater without any consideration to its sustainability is causing its over-exploitation in several areas Inter-State, inter-regional disputes in sharing of water hamper the optimum utilization of water through scientific planning. The existing water resources infrastructure is not being maintained properly resulting in under-utilization of available resources. Growing pollution of water sources is affecting the availability of safe water besides causing environmental and health hazards

Measures for effective water management : At present the water consumption in India is about 750 km^3/year for all the applications, viz. agricultural, industrial, domestic and commercial. Therefore the any water management in India must be holistic in nature where Centre, the States and the local bodies (governance institutions) must ensure access to a minimum quantity of potable water for essential health and hygiene to all its citizens, available within easy reach of the household through proper planning, development and management of water resources which need to be governed by national perspectives on an integrated and environmentally sound basis, keeping in view the human, social and economic need. Large water supply schemes to meet the urban as well as rural needs of water for both irrigation and drinking, and piped water supply schemes for drinking water are need of the hour. Governance through informed decision making is crucial to the objectives of equity, social justice and sustainability. Application of 3R principle by treatment of domestic/industrial effluents and recycling of usable water for irrigation and commercial purposes thereby diverting the water used in these areas for domestic consumption can prove an effective water management strategy. Employment of modern irrigation techniques like drip irrigation, sprinkler irrigation are found to be more efficient one where wastage of water is minimum.

Water conservation practices like rain water harvesting and artificial recharge of ground water sources should be employed at local level. It must be made compulsory for all new building and the government buildings. Government provides subsidy to the farmers for purchasing tube wells. The excessive use of tube wells is leading to fast depletion of ground water. At least in urban areas government may impose an extra levy on extracting ground water. Declining ground water levels in over-exploited areas need to be arrested by introducing improved technologies of water use, incentivizing efficient water use and encouraging community based management of aquifers. In addition, where necessary, artificial recharging projects should be undertaken so that extractionis less than the recharge. This would allow the aquifers to provide base flows to the surface system, and maintain ecology.

An effective mechanism should be established at national level and within each State to amicably resolve differences in competing demands for water amongst different users of water, as also between different parts of the state. Regular training and academic courses in water management should be promoted. These training and academic institutions be regularly updated by developing infrastructure and promoting applied research, which would help to improve the current procedures of analysis and informed decision making in the line departments and by the community. A general

awareness about water management is needed to be created and the community must proactively involve itself in the conservation of most vital resource of earth for its sustainable development. Decision support systems are required to be developed for planning and management of water resources project.

Approaches foe sustainable water resource management:

Rainwater harvesting: Rainwater harvesting is the accumulation of rainwater from rivers or roofs and its storage in a deep pit for reuse on-site, rather than allowing it to run off. Rainwater canbe collected from rivers or roofs, and in many places, the water collected is redirected to a deep pit (well, shaft, or borehole), a reservoir with percolation, or collected from dew or fog with nets or other tools. Its uses include water for gardens, livestock, irrigation, domestic use with proper treatment, indoor heating for houses, etc. The harvested water can also be used as drinking water, longer-term storage, and for other purposes such as groundwater recharge. Rainwater harvesting provides an independent water supply during regional water restrictions.

Watershed Management: Watershed management is the study of the relevant characteristics of a watershed aimed at the sustainable distribution of its resources and the process of creating and implementing plans, programs, and projects to sustain and enhance watershed functions that affect the plant, animal, and human communities within the watershed boundary. Features of a watershed that agencies seek to manage include water supply, water quality, drainage, storm water runoff, water rights, and the overall planning and utilization of watersheds. Landowners, land use agencies, storm water management experts, environmental specialists, water use surveyors and communities all play an integral part in watershed management.

Effluent treatment: Effluent treatment is the process of removing contaminants from wastewater, primarily from household sewage. Physical, chemical, and biological processes are used to remove contaminants and produce treated wastewater (or treated effluent) that is safer for the environment. A by-product of sewage treatment is usually a semi-solid waste or slurry, called sewage sludge. The sludge has to undergo further treatment before being suitable for disposal or application to land.

Water resource management: It is a concept which emphasize policies and strategies. Contributions examine planning and design of water resource systems, and operation, maintenance and administration of water resource systems. Coverage extends to these closely related topics: water demand and consumption applied surface and groundwater hydrology; water management technique simulation and modeling of water resource systems; forecasting and control of quantity and quality of water; economic and social aspects of water use; legislation and water resources protection.

CONCLUSION

Owing to current rate of population growth, India could well have the dubious distinction of having the largest number of water-deprived persons in the world in the next 25 years if the available resources are not managed judiciously and with care. It is estimated that by the year 2050, half of India's populationwill be living in urban areas and will face acute water problems. Furthermore, there are serious inequities in the distribution of water. Consumption of water ranges from16 litres per day to 3 litres per day depending on the city and the economic strata of the Indian consumer. Governments play and will continue to play a critical role in rural development and resource management. Governments define the legal, policy and institutional frameworks within which water resources are managed and rural economies and societies function. If every State adopts strategy to tap rain water, scarcity would be a matter, forgotten. Hence Water resource management is essential, not only in India but around the globe.

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Subsidies on Various Components under Integrated Horticulture Development Scheme from Department of Horticulture, Haryana

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INTRODUCTION

Subsidy:- An agricultural subsidy (also known an agricultural incentive) is a government incentive paid to farmers, agricultural organizations and farms to supplement their income, manage the supply of agricultural commodities, and influence the cost and supply of such commodities. Govt. of Haryana under Department of Horticulture is providing farmers various subsidies to encourage cultivation of Horticulture crops (Fruits, Vegetables, Flowers and Protected cultivation).

Horticulture:- The branch of agriculture dealing with garden crops, generally fruits, vegetables, and ornamental plants.

Integrated Horticulture Development (IHD):- IHD is a Horticulture scheme implement by Department of Horticulture, Haryana to promote cultivation of Horticulture crops and to increase farmer's income. A list various subsidies which a farmer can take from Horticulture department are listed below:

Sr. No.	Component	Unit	Unit cost (Rs.)	Rate of assistance (%)	Amount of assistance (Rs.)	Area limit in Ha
1.	Hybrid Vegetable cultivation	Ha	50000/-	40	20000/-	2
2.	Plastic Mulching	Ha	32000/-	50	16000/-	2
3.	Bamboo Stacking in vegetables crops	Ha	156250/-	50	78125/-	1
4.	Plastic tunnels	Sqm	60/-	50	30/-	10000 Sqm
5.	Promotion of IPM	Ha	4000/-	30	1200	2
6.	Promotion of INM	Ha	4000/-	30	1200	2
7	Tissue Culture Date Palm (8m*8m)	Ha	405600	75	304200	1
8	Pomegranate (5m*5m)	Ha	48000	75	36000	4
9	Pheromone/Sticky traps	Ha	4000	75	3000	4
10	Bee Hives	Box	2000	45	900	50
11	Bee Colonies	Colonies	2000	45	900	50
12	Iron stacking	Ha	352500	50	176250	1
13	Packing material for Strawberry	Box	27	50	13.50	5000
14	Mushroom (other than Button Mushroom)	Tray	300	50	150	100
15	Soluble Fertilizer	Ha	10000	50	5000	2
16	Mobile Retail Van	Van	800000	65	520000	1

General Guidelines and Eligibility Criteria for availing assistance:

- Norms and guidelines would be as per the GOI and State guidelines and norms fixed and issued time to time.
- The applicants have to submit an application (in prescribed Performa) to the concerned HDO/DHO for getting subsidy under the component for which he is interested.
- Only those Farmer &/or entrepreneur having land ownership in Haryana State shall be eligible and in case of non- ownership of land lease agreement for one year for one year crops and twenty years for orchards.
- Farmers who have taken assistance from any scheme of State or Govt. of India up to prescribed limit shall not be eligible for assistance under the scheme.
- Minors are not eligible.
- Beneficiary should not be repeated.
- Only one member from a family can take max amount of assistance on one ration card.

Document Check List for Application:-

- Application duly filled-in with photograph (hard copy) or online registration (POLYNET and MINET).
- Aadhaar Card
- Bank Detail (Beneficiary Name, Bank Name, IFSC code, Account No.)
- Ration Card/ Electricity Bill (Any one)
- Land record.
- Patwari Land verification report or Jamabandi/ Fard.
- Scheduled caste certificate.
- Lease agreement.

Where to apply: - Offline at concerned Horticulture Department at block level or apply online at http://hortharyanaschemes.org.in/

Thus, Farmers should tap the potential benefits of these financial assistance as provided by government in order to make agriculture as a profitable enterprise.

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Congress Grass: An Emerging Threat for Sustainable Crop Production in India

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INTRODUCTION

Parthenium hysterophorus L. which is commonly known as congress grass is a problematic weed of Asteraceae family. It is posing a serious threat to crop cultivation and also to human and animal health. It is native to Tropical America but now it has widespread in India, Africa, China, Vietnam, Pacific Islands and Australia. In India, it was first recorded in 1810 in Arunachal Pradesh and Nagaland and in Pune in 1955. By 1972, it has spreaded in every state of India. In general, the overall spread in terms of density and infestation level is that it is highest in Andhra Pradesh, Bihar, Chhatisgarh, Delhi, Haryana, Karnataka, Maharashtra, Madhya Pradesh, Punjab, Tamil Nadu and Uttar Pradesh. Congress grass has now achieved the status of the countries "Worst Weed" because of its allelopathic effects on agricultural crops and harmful effects on people and animals. During the 1980s, congress grass used to be considered a weed of rainfed fallow and wasteland but now it has become a weed of every crop.

Morphology of Congress grass

Congress grass is annual herb with a deep tap root and an erect stem that becomes woody with age. With the time, it develops many branches in its top half and may eventually reach a height of 2 m under favorable conditions. The leaves are pale green in color, deeply lobed and covered with fine soft hairs. The flowering starts 4 to 8 weeks after germination and it continues until the plant death. The flowers are small creamy white occur on the tips of the numerous stems. Each flower is having 4-5 black seeds that are wedge-shaped, two mm long with white scales. A single plant can produce 15000- 100000 seeds and these seeds can spread from one place to another by different dispersal mechanisms.

Impact of Congress grass on agriculture production

The congress grass is having severe negative impacts on pastures and forage crops. It has been reported that that infestation of congress grass reduced the forage production by up to 90%. It strongly competes with the crops like sunflower and sorghum and resulted in lower yield. It affects the nodulation process in legumes by inhibiting the activity of nitrogen fixing and nitrifying bacteria viz., Rhizobium, Actinomycetes, Azotobactor and Azospirillum. It was reported to cause yield losses of up to 40% in several crops. Its pollen through dispersal mechanisms can inhibit the fruit setting in crops like tomato, brinjal, beans, capsicum and maize when the pollen grains are deposited on the stigmatic surfaces. This weed acts as an alternate host for many diseases caused by viruses and also for insects like mealy bug in crop plants.

Management of Congress grass

It is of major importance to control *P. hysterophorus* in time before spreading, because of its negative impact on natural and agro eco-systems. There are different mehods to control this weed. The different approaches include manual, mechanical, chemical and biological control. Manual and mechanical approach consists of uprooting or hoeing the plants out. This approach is usually neither very effective nor economical because of the rapid re-growth requiring repeated removals for its long control. Further, it is not easy to get labor for congress grass uprooting as they fear about the ill effects caused by congress grass. Chemical method includes application of herbicides to kill the congress grass. This method is gaining popularity in India due to its timely and effective control. In this method the time of application of herbicide is most important. The herbicides should be applied before flowering and seed setting. The herbicides should be selected based on their availability and recommendation by state agricultural university. The biological method of weed control is most cost-effective, environmentally safe and ecologically viable method. The different types of insects and pathogens can be used in biological control. The leaf-feeding beetle *Zygogramma bicolorata* and the stem-galling moth *Epiblema strenuana* are widely used in several countries including India to manage the congress grass. Before the introduction of any biological agent, host specific test are to be conducted for the safety of crops. The mulching can also be used for smothering the *P. hysterophorus* by restricting the photosynthesis. Also mulching helps in conserves moisture, maintains surface temperature and improves the soil quality.

Parthenium hysterophorus

***Zygogramma bicolorata* beetle**

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Climate Smart Agriculture

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INTRODUCTION

CSA technologies adaption cum mitigation under exposing of changing climate in the ways of water, nutrient, energy, weather, knowledge smart practices enhance the productivity of agricultural products. Adaption of CSA techniques up scaling be productivity of crops specially exposing of changing climate. CSA may be defined as an approach for reorienting agricultural development under the new realities of climate change. Another words "agriculture that sustainably increases productivity, enhances resilience (adaptation), reduces/removes GHGs (mitigation) where possible, and enhances achievement of national food security and development goals". The goal of CSA is productivity, adaptation, and mitigation as the three inter linked pillars necessary.

Concept: Agriculture is at the intersection of three major challenges in the context of climate change (Saini *et. al.* 2009)

1. There is strong need to produce 60 % more food by 2050.
2. This increase in production need to occur even as the climate change are becoming more aggressive to crops, livestock and other systems globally.
3. The agriculture sector contributes 19–29 % of global greenhouse gas emissions, and would need to reduce emissions significantly in order to achieve the global goal of limiting warming.

CSA is based on 3 pillars:

Productivity: CSA aims to sustainably increase agricultural productivity and incomes from crops, livestock and fish, without having a negative impact on the environment.

Adaptation: CSA aims to reduce the exposure of farmers to short-term risks, while also strengthening their resilience by building their capacity to adapt and prosper in the face of shocks and longer-term stresses. Particular attention is given to protecting the ecosystem services which ecosystems provide to farmers and others.

Mitigation: Wherever and whenever possible, CSA should help to reduce and remove greenhouse gas (GHG) emissions. This implies that we reduce emissions for each calorie or kilo of food, fiber and fuel that we produce. That we avoid deforestation from agriculture and that we can management of soils and trees in ways that maximizes their potential to acts as carbon sinks (storage) and absorb CO_2 from the atmosphere source.

Key characteristics of CSA

1. **CSA addresses climate change:** To consider climate change for planning and development of sustainable agricultural systems is the attribute of CSA.
2. **CSA joins multiple goals:** CSA have three main goals i.e. increased agriculture productivity, enhanced resilience (adaption) and reduced (mitigation) GHGs emissions. So, trade-offs need to be made when implement CSA.
3. **CSA maintains ecosystems services:** Ecosystems provide farmers with essential services, such as clean air, water, food and materials. It is clear that CSA interferences do not contribute to their degradation.
4. **CSA has multiple entry points at different levels and is context specific:** CSA has multiple entry points, ranging from the development of technologies and practices to the embellishment of climate change models and scenarios, information technologies, and the strengthening of institutional and political enabling environments etc.
5. **CSA encourages women for their participation and engages marginalized groups:** To achieve food security goals and enhance resilience, CSA approaches must involve the poorest and most vulnerable marginalized groups. Because marginal farmers are more vulnerable to the climate change, so, they are most likely to be affected by climate change.

Dimensions of Climate Smart Agriculture

Distinctions can be made between capital saving (seed, chemicals fertilizers and pesticides, labor saving, quality improving, and risk reducing innovations. Another way of distinguishing innovations is according to their form, *e.g.* technological, managerial and institutional innovations. Technological innovations are embodied in new machinery and can be further divided into mechanical (*e.g.* tractors, cultivator, and combiner), biological (*e.g.* seeds, planting materials) and chemical (*e.g.* fertilizers, herbicides and pesticides) innovations.

Water- smart:

The efficiency of water use can be significantly increased through the adoption (resilience) of information intensive management practices that optimize the timing and amounts of application of inputs (fertilizers, herbicides and pesticides. Rainwater harvesting (RH), drip irrigation (DI), laser land levelling (LLL), and furrow irrigated raised bed system (FIRBS), SRI technology and direct seeded rice (DSR).

Energy-smart

Energy is needed in all goals along the agro-food chain in the production of crops, horticulture, aquaculture, livestock and forestry products; in post-harvest operations; in food storage and processing; in food transport and distribution; and in food preparation. Directly energy are including electricity, mechanical power, solid, liquid, coal, woods and gaseous fuels. Indirect energy related to the other hands, refers to the energy required to manufacture inputs such as machinery, farm equipment, fertilizers, herbicides and pesticides.

Zero Tillage/Minimum Tillage (ZT/MT)

Some effective residue management solutions retain plant residues and practices that minimally disturb the soil. In addition to potential increases in soil organic carbon and subsequently increased water infiltration and storage within the soil, effective crop residue management can dramatically decrease soil erosion through the protection of the soil surface from rainfall (Lal, 1997; Kumar *et.al.* 2018b).

Carbon-smart

Mixed crop livestock management systems, in which crops and livestock are established on the same farm, are the backbone of smallholder production in the developing countries of the tropics (Herrero *et. al.* 2010). It is estimated that they cover 2.5 billion hectares of land globally, of which 1.1 billion hectares are rainfed arable lands, 0.2 billion hectares are irrigated croplands, and 1.2 billion hectares are grasslands (Haan *et. al.* 1997).

Weather-smart:

According to (WMO, 2011) weather is the state of the atmosphere at a given time and location with respect to variables such as temperature, rainfall, wind speed, and barometric pressure. Climate refers to average weather in terms of the mean and its variability over a certain time-span and a certain area. Climate change is a change in the climate that persists for an extended period of time (WMO, 2011). Climate smart housing for livestock (CSH), Pradhan Mantri Fasel Bimayojna (PMFBY), weather based crop agro advisory (CA) and crop insurance (CI).

Knowledge-smart:

Universities, research institutions, extension workers and NGO's are in a good position to bring different stakeholders together, such as farmer communities, corporate organizations and government, including its agencies. Knowledge sharing and network platforms can take the form of master farmer and farmer field schools.

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IPM: A Solution for Doubling Farmers' Income

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INTRODUCTION

Past strategy for development of the agriculture sector in India has focused primarily on raising agricultural output and improving food security. That result into 45 percentincrease in food productionper person along with make India self-sufficient infoodand exporting country. The strategy did not recognize the need to increase farmers' income and any measure to endorse farmer welfare. This cause the farmer's income remainsat low level.Low income along with deteriorating disparity between farmer income and non-agricultural person build reason for agrarian distress in the country. The country also witnessed increase in the farmers suicides during 1995 to 2004 era due to losses from farming system ad low returns are important factors for this. Due to this, cultivators, particularly younger age group were force toleave farming that has serious effects on the future of agriculture in our country. Therefore, the goal of doubling farmers' income by 2022 is requires farmers welfare movement, agrarian distress reduction, equal status and income. Strong processesare needed to increase farmers' income within agriculture system as well as outside. The major sources of growth within agriculture sector are:

a) Improvement the crops productivity
b) Resource use efficiency or saving the cost of cultivation
c) Increase the cropping intensity of field
d) Diversification to high value crops
e) Improving trade

Strategy for improving Farmers' income

- **Reducing Costs through Low Input Agriculture (LIA)**

Reducing the costs without compromising the output can increase the income. Applicationof overdose of fertilizers and pesticides by farmers, use low external input, adopt sustainable agriculture.

Enhancing production through yield Increase

Yield of crops can increase by minimize crop losses especially due to attacks of pests and diseases and secondly, improve productivity of crops which help in more revenues generate.

Reducing the number of stored grain pests:

To control pests in a storage warehouse the following steps must be followed

a) **Monitoring**
b) **Identification**
c) **Control**
d) **Importance of Integrated Pest Management:**

1. For obtaining higher yields of any crop, chemicals play a significant role if use them in judiciously way to increase benefits and minimize its effect on non-targeted species which could play a important role in improving farm productivity and doubling farmers incomes.
2. Integrated Pest Management (IPM) is the modern approach to undertake a step-by-step method in ensuring good crop health. It ensures crop quality, decrease pest infestations, reduced the potential problems of pest resistance and increases consumer confidence.
3. IPM is a big part of the solution which includes safe and quality food production conserves non-renewable energy and improves farmer livelihoods.
4. It reduces amount of broad-spectrum pesticide that is used in the environment
5. It also minimizes the chances of pests developing resistance towards the specific pesticide and curtails the health related risk to humans.
6. IPM which includes the cultural, mechanical and biological methods of pest and advocates the need based judicious use of pesticides during cropping.
7. Integrated Pest Management is an environment and ecological friendly approach for managing pest problems.

Therefore, to secure the future of agriculture in India and to strengthen the livelihood of farmers, IPM is one of the crucial measures which helps in enhance income of farmers through reducing cost of production and increasing production by maintaining the food quality and environment.

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Visual Nutrient Deficiency Symptoms in Plants

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INTRODUCTION

To assess nutrients deficiency in plants, most agriculturists primarily depend on visual symptoms, soil analysis and plant tissue analysis. The seventeen essential plant elements are carbon (C), hydrogen (H), oxygen (O), nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sulphur (S), iron (Fe), zinc (Zn), manganese (Mn), copper (Cu), boron (B), molybdenum (Mo), chlorine (Cl) and nickel. Carbon, hydrogen, and oxygen are obtained from air and water. Nitrogen, phosphorus, and potassium are derived from general fertilizers. Calcium, magnesium, and sulphur are variously derived from calcium carbonate (limestone), calcium hydroxide (hydrated lime), dolomite (calcium and magnesium carbonate), epsom salts (magnesium sulphate), elemental sulphur, and sulphate salts. Iron, zinc, manganese, copper, boron, and molybdenum are derived from minor element formulations, including soluble foliar fertilizers.

Generally, a nutrient deficit arises as a result of low soil nutrient levels. However, prevailing environmental conditions, soil properties, growth conditions and root diseases can restrict nutrient uptake and induce deficiencies in crops even if soil nutrient levels are estimated sufficient for optimum yield. For example, low or high soil pH, soil compaction and overly wet or dry soil may prevent nutrient uptake. A helpful diagnostic method to diagnose nutrient deficiency in crops is by visual examination of symptoms. However, this tool does not always provide a definitive diagnosis of the nutrient status of the plant. Keep in mind other conditions are capable of causing symptoms that closely mimic those of nutritional deficiencies. To counter this, visual signs should be corroborated with plant tissue and soil testing, and review of the background of nutrient applications to the field. Adequate knowledge of visual symptoms and tissue testing can help direct corrective actions in-season or preventive action in the following season to avoid yield loss.

Symptoms associated with deficiency can take many forms including chlorosis, necrosis and irregular development. Chlorosis occurs when the production of chlorophyll is reduced which results in a yellow to pale green leaf colour.

Nitrogen (N), magnesium (Mg), sulphur (S), and iron (Fe) are nutrients that play important roles in chlorophyll development and function; thus, their deficiencies tend to trigger chlorosis. Next is W 976 necrosis, which happens when the plant tissue dies. Necrosis is generally associated with N, phosphorus (P), and potassium (K) deficiencies. Abnormal growth occurs when insufficient quantities of a nutrient in the plant inhibit cell elongation and replication resulting in stunted growth, deformation or crinkled leaves. Where the symptomology occurs on the plant depends on the mobility of the nutrient inside the plant. Plant nutrients may be categorised as mobile or immobile within the plant. Mobile nutrients such as N, P, K and Mg can be translocated from the older leaves to the growing plant sections. Hence, deficiency symptoms appear to show on older, lower leaves. On the other hand, immobile nutrients like Calcium (Ca), Sulphur (S), and most micronutrients have restricted mobility within plants and deficiency symptoms occur in younger, upper leaves. Since plant nutrients can be mobile or immobile, it is important to understand how to sample tissue correctly for accurate results. Sampling an older leaf or trifoliate can result in the mobile nutrient concentration being falsely low. Sampling a younger leaf or trifoliate can cause mobile nutrient results to be too high.

Visual assessment of nutrient stress should be used only as a complement to other diagnostic methods (i.e., soil and plant analysis) (i.e., soil and plant analysis). Nutrient deficiency symptoms can be listed as follows:

1. Complete crop failure at the seedling stage.
2. Severe stunting of plants.
3. Specific leaf symptoms appearing at different times throughout the season.
4. Internal anomalies such as clogged conductive tissues.
5. Delayed or irregular maturity.
6. Obvious yield variations, with or without leaf symptoms.
7. Poor quality of crops, including differences in protein, oil, or starch content, and storage quality.
8. Yield differences detected only by careful experimental work.

Each symptom must be linked to some role of the nutrient in the plant. A given nutrient can have many roles, which makes it difficult to understand the physiological explanation for a specific deficiency symptom. For example, when N is deficient, the leaves of most plants become pale green or light yellow. When the quantity of N is restricting, chlorophyll production is decreased, and the yellow pigments, carotene and xanthophylls are seen by a number of nutrient deficiencies formed such as pale green or yellow leaves, and the deficiency must be further linked to a specific leaf pattern or position on the plant.

Precautions in interpreting nutrient deficiency

Apparent visual impairment symptoms can be caused by several causes other than a particular nutritional stress. Precautions in understanding nutrient deficiency signs include the following:

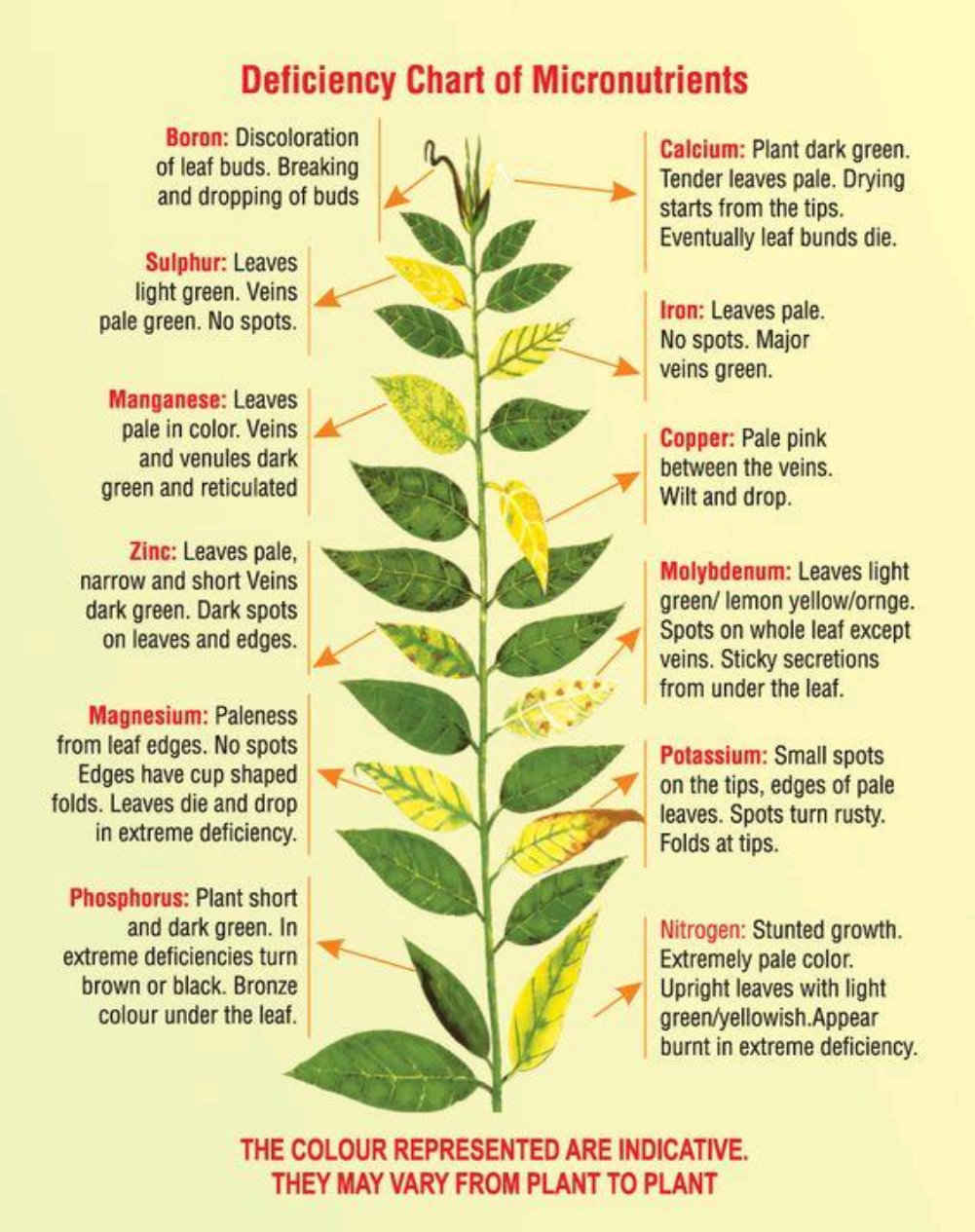
1. The visual symptom may be caused by more than one nutrient. For example, N-deficiency symptoms may be identified, although S may also be deficient and its symptoms may not be readily apparent. B deficiency is accompanied by a red coloration of the leaves near the growing point when the plant is well supplied with K. on the other hand, when the K content is low, yellowing of alfalfa leaves occurs.
2. Deficiencies are actually relative, and a deficiency of one nutrient may be related to an excessive quantity of another. For example, Mn deficiency may be induced by adding large quantities of Fe, provided that soil Mn is marginally deficient. Also, at a low level of P supply, the plant may not require as much N compared to normal or adequate P. In other words, once the first limiting factor is eliminated, the second limiting factor will appear (Liebig's law of the minimum).
3. It is often difficult to distinguish among the deficiency symptoms in the field, as disease or insect damage can resemble certain micronutrients deficiencies. For example, leaf hopper damage can be confused with deficiency in alfalfa.
4. A visual symptom may be caused by more than one factor. For example, sugars in corn combine with flavones to form

anthocyanins (purple, red, and yellow pigments) and their accumulation may be caused by an insufficient supply of P, low soil temperature, insect damage to the roots or N deficiency.

Nutrient deficiency signs occur soon when the nutrient supply is so poor that the plants can no longer function properly. In such situations, it would have been profitable to have applied fertilizer long before the symptoms appeared. If the signs are observed early, it may be corrected during the growing season. Since the goal is to bring the limiting nutrient into the plant as quickly as possible, with some nutrients and under some circumstances this can be achieved with foliar applications or side dressings. Usually the yield is reduced below the quantity that would have been produced if sufficient nutrients had been available at the beginning. However, if the issue is correctly diagnosed, the deficiency can be corrected the following year.

Table 1: Generalized Visual Leaf and Plant Nutrient Element Deficiency and Excess Symptoms

Element/status		Visual symptoms
Nitrogen (N)	Deficiency	Appear first on older (lower) leaves. V-shaped yellowing starting from the tip and progressing down the midrib towards the base of the leaf. Light green leaf and plant colour with the older leaves turning yellow, leaves that will eventually turn brown and die. Plant growth is slow; plants will be stunted, and will mature early.
	Excess	Plants will be dark green in color and new growth will be succulent; susceptible if subjected to disease and insect infestation; and subjected to drought stress, plants will easily lodge. Blossom abortion and lack of fruit set will occur.
	Ammonium toxicity	Plants fertilized with ammonium-nitrogen (NH_4- N) may exhibit ammonium-toxicity symptoms, with carbohydrate depletion and reduced plant growth. Lesions may occur on plant stems, there may be a downward cupping of the leaves, and a decay of the conductive tissue at the base of the stem with wilting of the plants under moisture stress. Blossom-end rot of fruit will occur and Mg deficiency symptoms may also occur.
Phosphorus (P)	Deficiency	Stunted, dark green to bluish-green plants. Appear first on older (lower) leaves. Reddish-purplish leaf tips and margins.
	Excess	Phosphorus excess will not have a direct effect on the plant but may show visual deficiencies of Zn, Fe, and Mn. High P may also interfere with the normal Ca nutrition, with typical Ca deficiency symptoms occurring.
Potassium (K)	Deficiency	On the older leaves, the edges will look burned, a symptom known as scorch. Plants will easily lodge and be sensitive to disease infestation. Fruit and seed production will be impaired and of poor quality.
	Excess	Plants will exhibit typical Mg, and possibly Ca deficiency symptoms due to a cation imbalance
Calcium (Ca)	Deficiency	The growing tips of roots and leaves will turn brown and die. The edges of the leaves will look ragged as the edges of emerging leaves stick together. Fruit quality will be affected with the occurrence of blossom-end rot on fruits.
	Excess	Plants may exhibit typical Mg deficiency symptoms, and when in high excess, K deficiency may also occur.
Magnesium (Mg)	Deficiency	Older leaves will be yellow in color with interveinal chlorosis (yellowing between the veins) symptoms. Plant growth will be slow and some plants may be easily infested by disease.
	Excess	Results in a cation imbalance showing signs of either a Ca or K deficiency.
Sulfur (S)	Deficiency	A general overall light green color of the entire plant with the older leaves being light green to yellow in color as the deficiency intensifies
	Excess	A premature senescence of leaves may occur.
Boron (B)	Deficiency	Abnormal development of the growing points (meristematic tissue) with the apical growing points eventually becoming stunted and dying. Rowers and fruits will abort. For some grain and fruit crops, yield and quality is significantly reduced.
	Excess	Leaf tips and margins will turn brown and die.
Chlorine (Cl)	Deficiency	Younger leaves will be chlorotic and plants will easily wilt. For wheat, a plant disease will infest the plant when Cl is deficient.
	Excess	Premature yellowing of the lower leaves with burning of the leaf margins and tips. Leaf abscission will occur and plants will easily wilt.
Copper (Cu)	Deficiency	Plant growth will be slow and plants stunted with distortion of the young leaves and death of the growing point.
	Excess	Fe deficiency may be induced with very slow growth. Roots may be stunted.
Iron (Fe)	Deficiency	Interveinal chlorosis will occur on the emerging and young leaves with eventual bleaching of the new growth. When severe, the entire plant may be light green in color.
	Excess	A bronzing of leaves with tiny brown spots on the leaves, a typical symptom frequently occurring with rice.
Manganese (Mn)	Deficiency	Interveinal chlorosis of young leaves while the leaves and plants remain generally green in color. When severe, the plants will be stunted.
	Excess	Older leaves will show brown spots surrounded by a chlorotic zone and circle.
Molybdenum (Mo)	Deficiency	Symptoms will frequently appear similar to N deficiency. Older and middle leaves become chlorotic first, and In some instances, leaf margins are rolled and growth and flower formation are restricted.
	Excess	Not of common occurrence.
Zinc (Zn)	Deficiency	Upper leaves will show interveinal chlorosis with an eventual whiting of the affected leaves. Leaves may be small and distorted with a rosette form.
	Excess	Fe deficiency will develop.



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Maydis Leaf Blight (MLB): An Important Disease of Maize

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INTRODUCTION

Maydis leaf blight (MLB) is an important disease of maize which is caused *Bipolaris maydis* and is reported from most maize growing regions of the world including India. It is also known as southern corn leaf blight (SCLB). The occurrence of any disease depends on environmental prevailing that time, cultural practices and hybrid that is under consideration. It can be most serious and dangerous disease in warm or wet temperate and particularly in tropical areas where yield losses go upto 70 percent due to the disease. The production of spore of this disease is influenced mainly by temperature present. The infected tissues are covered with spots and chlorosis due to it can render them non-productive. It is found to have a highly saprophytic ability and primary inoculum level that found in areas with high disease occurrence.

Scientific classification

Kingdom:	Fungi
Division:	Ascomycota
Subdivision:	Pezizomycotina
Class:	Dothideomycetes
Order:	Pleosporales
Family:	Pleosporaceae
Genus:	Bipolaris
Species:	*B. maydis* (Cochliobolus heterostrophus)
Binomial name:	*Bipolaris maydis* Nisikado & Miyake

Distribution

Jammu & Kashmir, Himachal Pradesh, Sikkim, Meghalaya, Punjab, Haryana, Rajasthan, Delhi, Uttar Pradesh, Bihar, Madhya Pradesh, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu.

Symptoms

The symptoms "O" strain of the fungus appears as young small and diamond type shaped lesions. As they mature, they elongate. The growth is limited by adjacent veins and final lesion shape is rectangular and 2-3 cm long. Lesions may coalesce, producing complete burning type large areas of the leaves, where as "T" strain can cause severe injuries to maize varieties in which Texas source of male sterility incorporated. Lesions produced by the T strain are oval and larger than those produced by the O strain.

Hosts

The primary host of southern corn leaf blight is maize crop also known as corn in the US. The various types of corn having normal cytoplasm (N) are more vulnerable to Race O. They have cytoplasm resistance to T-toxin of *Bipolaris maydis* (produced by Race T). The absence of gene is available only in plants with Texas male sterile cytoplasm is reason for resistance. Corn plants with T-cms cytoplasm have maternally inherited the gene T-urf 13 which encodes for a protein component of inner mitochondrial membrane. T-toxin acts on that portion of the mitochondria. Similarly, Race C is only pathogenic to the hosts with cytoplasm male-sterile C. SCLB can also be infected sorghum and teosinte crop.

Race Overview

Race/ toxin produced	Susceptible Host
Race O / O-toxin	Maize with normal cytoplasm (N)- most maize plants
Race T / T-toxin	Maize with Texas male sterile cytoplasm (T-cms)- these plants have gene T-urf 13, which encodes for T-toxin's site of action
Race C / C-toxin	Maize with cytoplasm male sterile C (C-cms)- currently found only in China

Favourable Conditions

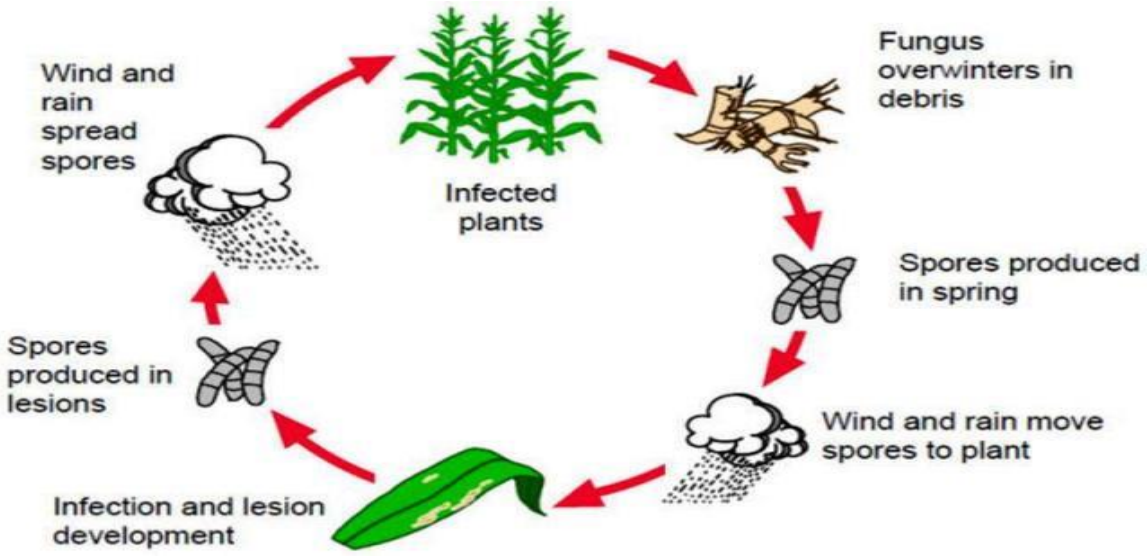
MLB favours warm and moist conditions for development. Late sowing, high humidity (>80%) and temperature of 25 ± 2^{o}C favours the development of disease. The extended moist conditions are essential for fungi to germinate quickly and effectively. Highly dense maize with minimum tillage are good for spread of its spores that can easily be blown from one plant to another plant.

Disease Cycle

The disease cycle of *Bipolaris maydis* is polycyclic and releases either asexual conidia or sexual ascospores to infect the maize plant. The asexual cycle is also known to occur in nature. Under favourable moist and warm conditions available, the conidia (the primary inoculum) are released from lesions of an infected plant and carried to nearby present plants via splashing rain or wind. Once conidia

have occurred on the leaf or the sheath of a healthy plant, *Bipolaris maydis* will germinate on tissue by way of polar germ tubes. The germ tubes either penetrate through leaf or enter through a natural opening known as the stomata. The parenchymatous leaf tissue is invaded by the mycelium of the fungus; the cells of the leaf tissue subsequently begin to turn brown and then collapse. These lesions give rise to conidiophores which then after getting favourable conditions; it can either further infect the original host plant (kernels, leaves, stalks, husks) or the release conidia to infect other nearby plants. The term 'favourable conditions' means that when water is present on surface of leaf and the temperature of the environment is between 60 to 80 ^{0}F. Under these available conditions, spores germinate and penetrate into the plant in 6 hours. The fungus remains overwinters in the corn debris as mycelium and spores and waiting for these favourable spring conditions. The generation time for new inoculum is only 51 hours.

As the previously mentioned, *Bipolaris maydis* also has a sexual stage with ascospores, but this only observed in laboratory culture. Its ascospores are found only in the ascocarp *Cochiobolus*, a type of perithecium found rare in nature. Thus, the main route of SCLB infection is the asexual via conidial infection.



Management

1. Ploughing down of crop debris may reduce early infection and destroy the infected crop residue in the field.
2. Spray of Dithane M-45, Zineb @ 2g/litre water followed by 2 to 4 applications.
3. Soil application of *P. fluorescens* (or) *T. viride* @ 2.5 kg / ha + 50 kg of well decomposed FYM (mix 10 days before application) or sand at 30 days after sowing.
4. Rogue out affected plants.
5. Grow improved varieties

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Crop Diversification in Agriculture

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INTRODUCTION

Crop diversification refers to a strategy of shifting from less profitable and unsustainable crop or cropping system to more profitable and sustainable crops or cropping system through the use of resources in the best possible way by changing and modifying the spatial and temporal cropping activities on a particular farm. It minimizes the adverse effects of the current system of crop specialization and monoculture for better resource use, nutrient recycling, reduction of risks and uncertainty and better soil conditions. Following the cropping systems with high productivity, profitability and sustainability. It also takes into account the economic returns from different value-added crops and improvement in ecology. It implies a shifting of resources from low value crops to high value crops, usually intended for human consumption such as fresh market fruits and vegetables. It is a strategy to maximize the use of land, water and other resources and for the overall agricultural development in the country. It is also practiced with a view to avoid risk and uncertainty due to climatic and biological vagaries. Diversion of high water requiring crops (rice) with less water requiring crops (maize, legumes vegetable). With globalization of the market, crop diversification in agriculture means to increase the total crop productivity in terms of quality, quantity and monetary value under specific, diverse agro-climatic situations world-wide. Inclusion of pulses, oilseed sand vegetables in the system is more beneficial than cereals after cereals, and such inclusion in a sequence changes the economics of the crop sequences.

Two different type of crop diversification in agriculture

A) The horizontal crop diversification refers to the addition of more crops to the existing cropping system. Here, adding more crops to the existing cropping system utilizing techniques such as, multiple cropping coupled with other efficient management practices. To improve the overall productivity of a farm or region's farming economy.

B) The vertical crop diversification approach in which farmers and others add value to products through processing (canned or processed into juices or syrups), regional branding, packaging, merchandising, or other efforts to enhance the product.

Need of Crop Diversification

The conventional cropping system facing the various sustainable issues asdegradation of natural resources (water, land) and environment along with various risks associated with *viz*., market, pricerisk with existing crop-management practices. To counter all the issues crop diversification is need of hour, it helps in;

- Natural resources sustainability
- Ecological Balance
- Raising agricultural productivity per unit of land
- Reducing rural poverty through a socially inclusive strategy that comprises both agriculture as well as non-farm employment.
- Ensuring self-sufficiency in food.

Indian agriculture is characterized by a dominance of small and marginal farmers (almost 68 per cent) who suffer as a result of difficult socio-economic conditions. Income from these farms cannot be raised up to the desired level to sufficiently alleviate poverty unless existing crop production systems are diversified through inclusion of high value horticultural and arable crops.

Advantage of Crop Diversification

- ✓ Increasing income on small farm holdings.
- ✓ Withstanding price fluctuation.
- ✓ Mitigating ill-effects of aberrant weather.
- ✓ Employment generation through creation of off-farm and non-farm investment opportunities within the capabilities of the resource-poor farmers.
- ✓ Changes in crop patterns and farming systems (by inclusion of pluses and legumes)
- ✓ Balancing food demand and improving fodder for livestock.
- ✓ Conservation of natural resources (soil, water, etc.).
- ✓ Minimizing environmental pollution.
- ✓ Reducing dependence on off-farm inputs.
- ✓ Decreasing insect pests, diseases and weed problems.
- ✓ Increasing community food security

Challenges in Crop Diversification

- ✓ Majority of the cropped area in the country is completely dependent on rainfall.
- ✓ Sub-optimal and over-use of resources like fertilizers, land and water, causing negative impact on the sustainability of agriculture.
- ✓ Fragmentation of land holding, less favoring modernization and mechanization of agriculture.
- ✓ Very weak agro-based industry and lack of proper market facilities.
- ✓ Inadequately trained human resources together with persistent and large scale illiteracy among farmers and of technical knowledge to farmer.
- ✓ Decreased investment in agriculture sector over the years.

In Haryana, government launched a financial incentive-linked crop diversification drive to encourage farmers to switch over to alternate crops in place of water guzzler paddy under the Mera Pani-Meri Virasat Scheme. The objective of this scheme is to encourage farmers to cultivate alternate crops such as maize in the area that was under paddy cultivation last year. Because the cultivation of rice crop has contributed to degradation of natural resources such as water and soil. Also, the ground water table of Haryana has been declining steadily.

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Improved Agronomic Practices for Castor Cultivation

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INTRODUCTION

Varieties

DCH 177: The primary spike of DCH 177 matures in 90-100 day. This is a high yielding variety suitable for both rainfed as well as irrigated area. The seed yield of this variety 6-12 qt/ ha in rainfed and 16-24 qt/ha in irrigated area of Haryana. This is a known for non shattering variety and resistant to white fly, root rot, wilt and lodging.

ICH 66: The primary spike of ICH 66 maturing 94-97 days. This is a high yielding hybrid suitable for both rainfed as well as irrigated area. The seed yield of this hybrid 6-12 qt/ha in rainfed and 16-25 qt/ha in irrigated area of Haryana. This hybrid is resistant to Jassid, root rot and wilt.

Sowing time: Optimum time of sowing of the castor hybrid in north India (Haryana, Punjab, U.P. and western Rajasthan) from last week of June to first fortnight of July.

Seed rate and spacing: In rainfed and low irrigated area the castor hybrid is sown at spacing of 90 x 60 cm with seed rate 3 kg/acre. In irrigated area, this is sown at spacing of 150 x 90 cm with seed rate 1.6 kg/acre. The depth of seed sowing should be 2-3 inches. The seed of Castor hybrid should be soaked in water for 12-24 hours before the sowing, it helps in improving seed germination.

Seed treatment: The seed and soil should be treated in thiram and captan @ 3 g/kg seed or bavistin @ 2 g/kg seed for controlling the attack of insect pest.

Fertilizer: In rainfed castor 8 kg nitrogen and 16 kg phosphorus should be apply before sowing the crop. The remaining two doses of nitrogen (8 kg- 8 kg) apply at 35-40 days after sowing (DAS) and 65-70 DAS. In irrigated area 8 kg Nitrogen, 16 kg phosphorus should be apply at the time of sowing and remaining two doses of Nitrogen (8 kg – 8 kg) apply at 35-40 DAS and 75-80 DAS. The application of 10-12 kg potash, 10 kg zinc sulphate and 100 kg gypsum at the time of sowing. It beneficial for higher crop production.

Irrigation: During initial stage of castor hybrid, does not requires much water, if there is prolong dry spell of 20-25 period days, it requires irrigation. Depending upon soil water holding capacity, it requires 3-4 to 5-6 irrigation. The critical stage of irrigations is 50-60 days after sowing and 80-95 DAS. During summer season irrigation should be apply at interval of 15-20 days and during winter at 25-30 days interval.

Intercultural operation: In initial stage castor is very sensitive to weed problem. Weed can be controlled effectively with two hand hoeing (4^{th} and 7^{th} weeks after sowing). Like cotton crop hoeing can also be carried with help of tractor, bullock and camels. Before germination spray of 800 ml pendimethalin is beneficial for weed control.

Insect control: The attack of insect is the major constraint in Castor production. Which includes chewing types, sucking type and Borer insect. But they can control effectively with 1-2 spray of insecticide.

Harvesting: Harvesting is done when some capsule become yellowish while some capsule become brownish in the spike. First spike get ripened after 90-120 DAS. Then harvesting is carried out at 25-30 Days intervals. Harvesting gets completed in 4-6 times. Generally, In irrigated condition the harvesting should be completed in the end of April or 1^{st} week of May.

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Application of Cloud Computing in Agriculture Sector

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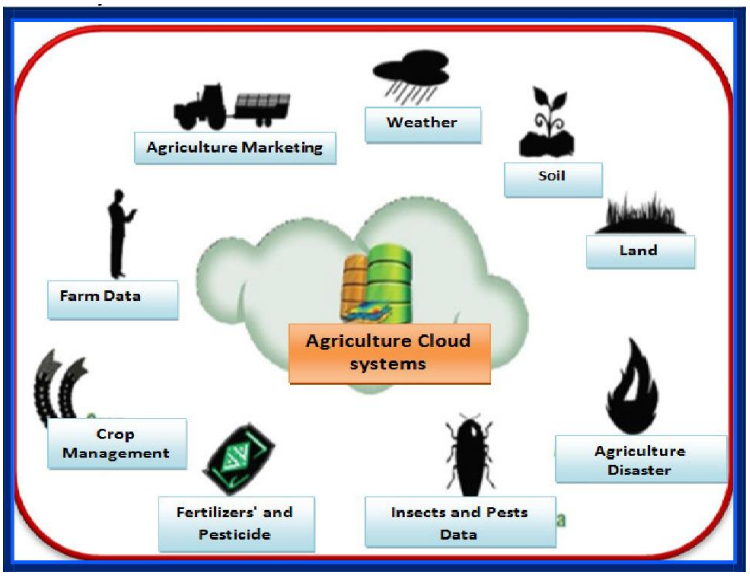
INTRODUCTION

Over the years, computing technologies have played an important role in every field such as transportation, healthcare, smart online shopping, smart education, or warehouses. Computing technologies in every field and region make it easy for humans to follow their information. The goal of this technology in every field is to provide real-time, reliable, effective, secure information when needed. In addition, computing technology provides technology to each individual to make it easier in user-friendly environments. On the other hand, since communication and information have always been an important part of humanity, the main goal of technology is to improve communication in various fields.

As we know agriculture is the backbone of Pakistan's economy. This article highlights the application of cloud computing within agriculture development, as a result of the utilization of each resource on time is extremely vital for the expansion of agriculture. Therefore, the importance of the application of cloud computing in the agriculture sector has been studied significantly. Though the technology cloud computing and net tend to attach the varied objects within the world to the web.

So, to handle and to avoid challenges two-faced by the assembly of food, there's want for the technology to speak and to handle the knowledge regarding resources of agriculture sectors properly. Therefore the introduction to these technologies is a nice breakthrough in the agriculture era. In recent years, new ICT technologies have been implemented in every region of developing countries and the role of ICT in the agricultural sector has always been very important because of the unpredictable nature of the latter. Domain cloud computing is ICT's new application that can be used extensively and aptly for the advancement of the agricultural sector.

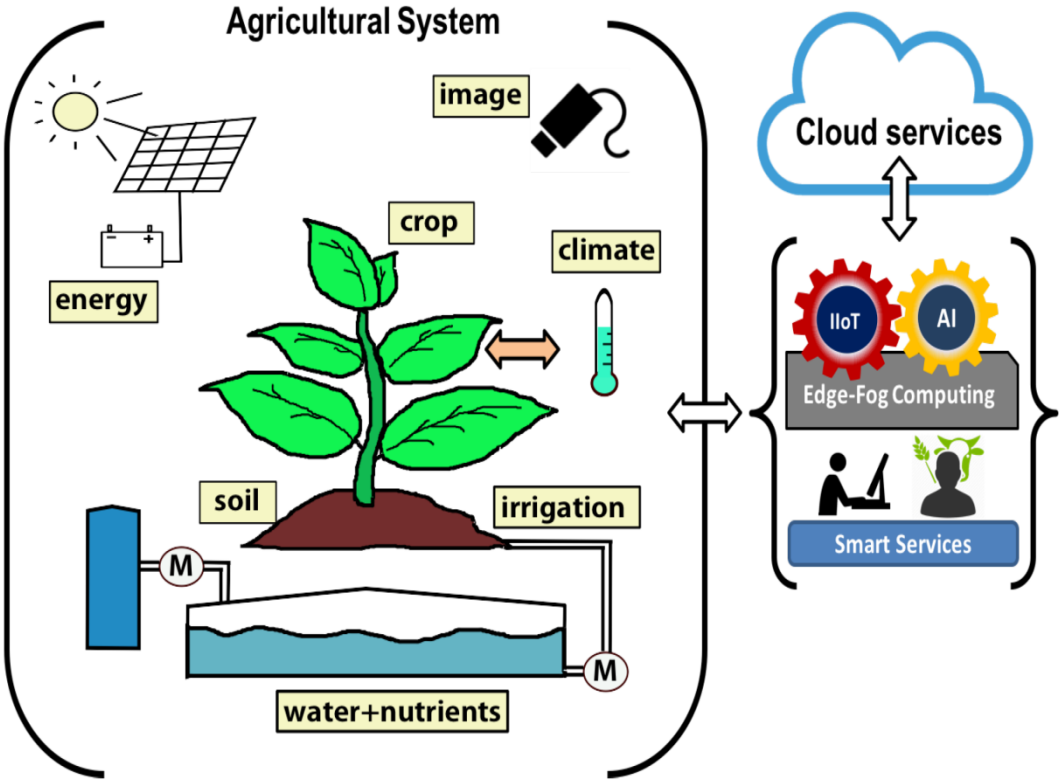
Cloud computing is a general term used to describe a new and modern class of network-based computing that occurs over the Internet. This article introduces the concept of cloud computing implementation in Pakistan's agriculture. It intends to introduce a cloud computing model with two main components, the first of which is the cloud agro system to monitor and meet user needs with a user-friendly and fast approach, which includes services such as demand-supply, communication, communication tools, e-knowledge, e-data bank, which stores all relevant data in a centralized location, monitors crop-related weather, soil information, and development progress. There are clouds of farmer data etc., so, if we have to improve their financial situation. Developing countries are trying to reform the Pakistan's agricultural sector. This technology has attracted the attention of the governments of various countries like the United States, the Britain, Japan, and other developed countries, and all have begun to use the national cloud computing infrastructure for the future development and growth of their agricultural sector.



Cloud-based technology is an evolving solution to better manage agricultural processes. Cloud computing refers to the sharing of technology over the Internet and facilitates farmers to convert and analyze data, much like cloud computing in agriculture. Stores data about related topics; data on weather conditions, waterlogging, pest disease, crop production, crop model database, and critical database. Cloud computing platforms require less work to facilitate the development of agriculture. Cloud computing data can be accessed everywhere and by various researchers, workers and farmers. Farm farmers and workers do not have the technical skills to use cloud services or use other technologies. No doubt agriculture is an important sector of Pakistan but it is facing several challenges, like; lack of modern agricultural technology, waterlogging and

salinity, the use of traditional production methods, lack of knowledge and insect/pest & diseases of crops etc. Lack of proper mechanism for these challenges, lack of information about crops, lack of information about climate and crop diseases make the farmer and worker do not have a proper understanding of agriculture.

An application of cloud computing can help solve these challenges. Cloud can provide a kind of bank that can store all the information related to agriculture. This information is available to farmers and other consumers in the agricultural sector to collect data for them anywhere and anytime. Cloud computing technology provides a platform for workers, farmers, and researchers to not invest in software and hardware. These farmers, workers, and researchers can adopt crop control methods as well as pest control and disease control methods, they can also monitor issues related to animals and plants.



Some of the clouds computing applications for agriculture are given as:

- **Database for weather regarding information:** It helps to know the specific weather conditions and climatic conditions for seasonal crops through weather forecasting.
- **Database for disease-related information**: This will help in getting information about the pest disease, which attacks the crops and damages the crops as Pakistan is suffering from the worst locust attack on the crop and destroying the crop.
- **Database for a new technique of crop production**: It makes various tools to learn about new systems and new methods of crop production. It also stores information about a specific crop grown in a specific area.
- **Sharing of agriculture information:** It is another application of cloud computing because cloud computing has powerful network access so it plays

an important and easy role in providing information and sharing about agricultural challenges to the users. It is another application of cloud computing because cloud computing has powerful network access so it plays an important and easy role in providing information and sharing about agricultural challenges to the users.

- **Monitoring of Agricultural product quality:** Cloud computing technology continues to provide scientific research, access to raw materials, crop production, storage and transportation, marketing, quality of information services, product quality monitoring, and more.
- **Real-time monitoring of crops**: One of the applications of cloud computing in agriculture, provides monitoring information and status about crop growth, leaf circumference, stem height, leaf diameter, and root height, which also monitors fertilizer and water quantity in the soil.
- **Providing agricultural science and technology:** As an important ancillary technology of digital agriculture, cloud computing technology provides advanced information technology services and digitizes, controls, designs, and maintains all agricultural-related goods and digitizes and expresses the whole process. Agricultural extension, education, and scientific research achieve recognition in cloud computing environments. In addition, cloud computing technology can be used to build accurate agricultural technology and equipment systems that use advanced agricultural product information and professional geographic information software to obtain biological relationships between agricultural production and operational processes.

Cloud computing based technology is an important component in the development of agriculture, the benefits of these applications are; increased GDP and the economic condition of the country, eliminate technical problems for farmers, accessing data anytime and anywhere, and provide global and local communication, cloud does not require proper skills to use cloud services, and farmers inspire farmers and researchers.

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Strategies for the Betterment of Extension Department

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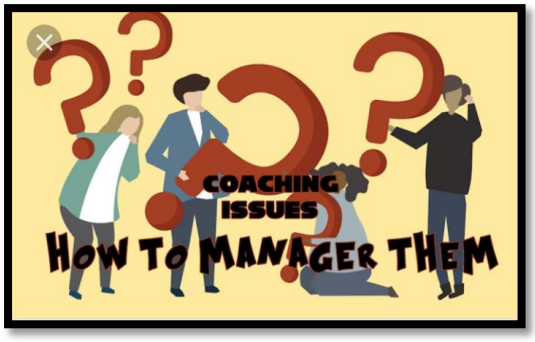
INTRODUCTION

We are living in the 21st century and the world is growing up very fast, but we as a Pakistani nation are unable to match with the race of the world because we are facing several problems in every department. In agricultural- countries extension programs have been the main conduit for disseminating information on-farm technologies, support rural adult learning and assist farmers in developing their farm technical and managerial skills. But we also lack in this department. So, it's a basic need of the hour that we may emphasize our deficiency to compete with the world. Being an agricultural country we all are directly and indirectly associated with agricultural products. For the betterment of agriculture, the departments who worked for the betterment of these sectors must be up to mark. One of the main department who is directly concerned with agriculture is an extension which plays a significant role in the dissemination of information. But in recent times extensionsystem inPakistan is under heavy pressure. The professional and technical competence of extension out research staff is not up to the mark, according to the need and demand of the rural community. Now there is a need to develop agricultural extension policies to revitalize the agriculture extension system of Pakistan.So, to bring desirable change in the extension department for the betterment of agriculture we may apply some strategies for its development.

Before we look up at the strategies for the betterment of this sector we should know about strategy "strategy is a method or plan chosen to bring about desirable change in future for the achievement of goals or solution to a problem under conditions of uncertainty". Next thing, which comes in our mind why there is need to apply strategies. It may create a clear vision and direction for the whole organization to make it more active, prevent from losing the aim, learner should understand what they must do to achieve, a specified competency based on their strategies. After preparing of strategy we may take an initiative step. So initial step for bringing change is observation. Until you don't observe the thing then you will not be able to find out the good and bad aspects. To know about your definiteness observe every point, and find out the drawbacks why we are facing difficulties and by applying which method we can improve it. Find out the drawbacks and then try to overcome these drawbacks through different strategies.

"A vision without a strategy remains an illusion"



Here we will discuss some strategies, which would be much beneficial for the agricultural extension department. Firstly check the selection criteria because it's the beginning step of betterment, workers should be selected based on merit. The main criteria for the selection should be their skills and knowledge about their specific field. Don't give preference to commendation. After selection, the next thing that is much needed is skilled staff because the staff is one of the main controllers of any department and especially this field mainly depends upon the efficiency of their workers. Then, provide necessary skills to your staff. They must have proper knowledge and skill regarding their relevant subject and they must be aware of their responsibilities and how to communicate with people in the field. As communication skills are much needed because if a person lacks these skills then he will face several issues in the field while communicating with the farming community. As proper knowledge is the key element of success, until, we don't have proper knowledge then the workers wouldn't be able to disseminate it to the farmers properly. Accurately guide your staff before they guide others. Guidance is much needed for efficiency of work guide your farmers about the innovation. It would be beneficial not only for farmers but also for society because when farmers will be aware of new techniques and apply them in the field it would be beneficial for all of us.

If workers may give the right and proper information to the farmers at the proper time they will gain the trust of people, which should be beneficial for them in the future and for other extension workers. Proper assembling of knowledge is much needed. Information should be well assembled about agriculture practice suited to a particular environment, for a particular purpose at a particular time. If we guide them about the incoming problems soon they will do some precautionary measures for them, which would prove significant for them. We must use social networks for the dissemination of information. It is found that the first preferred source of information for farmers is the colleagues or fellow farmers. If we may urge them to disseminate this information (which they gain in different extension training and meetings) with their fellows it will surely bring a positive response. Target the female workers as women are an important part of society from every point of view, and especially the women of rural areas are involved in various farming and non-farming activities like crop protection, livestock rearing, and management. So, skill development is particularly important for rural women. Arrange a different kind of training for their counselling. Create ease for workers, main obstacle faced by the extension staff is the insufficient fund, provide the necessary funds. Provide them proper transportation system; make a strong bonding and cooperation among employers and head of department because if they lack cooperation among themselves it will create several problems for the whole department. Address the current issues, focus on the issues, which have been faced by farmers in recent time and near future. Research on these problems to get useful information, which can be used for solving problems, should be encouraged. Through this we can understand the complexities of various issues; so that we can adopt some remedies for them. Use of modern technology is necessary in recent times to compete with the world. Production and time are some of the important element in any field, time bring change. As technology has also increased the productivity of almost every industry in the world, because it saves time and effort, brings innovations. So it's need of the hour to use the modern technology for better result.

Now there is a need to develop agricultural extension policies to revitalize the agriculture extension system of Pakistan. Information should be properly assembled. A proper system should be established and conducted. There must be some legislation that enables agriculture extension workers to occur. The world is growing up very fast now it becomes a global village. But we are still regarded as an underdeveloped country it's because we are facing several problems regarding production, poverty, and overpopulation, now it's time to overcome these problems. Central government and development partners should commit more human, financial, and logistical resources to agricultural extension delivery in the country to boost agricultural productivity, farm incomes, and total household income. Also,

access to agricultural credit and the formation of farmer groups such as farmer-based organizations should be promoted for agricultural extension service delivery to realize its full impact. If may not pay proper heed to these problems we will be left behind in the race of the world. If we may focus on these problems then we can bring a desirable change soon. We hope so that we will surely bring it through proper management and different policies of the government and private sectors.

"If agriculture goes wrong nothing else will have a chance to go right'

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Harvesting Solar Energy to Harvest Bumper Crops

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INTRODUCTION

Indian farming is passing through distress at the times when the fuel and electricity charges are sky high. In the states were cropping intensity is very high, these costs are adversely affecting the profitably. Animals used in agricultural operations for draft are now beast of burden as to maintain these animals is proving costly. The share of draft power using animals have drastically reduced in past decade due to mechanization. The number of some species of pack animals have come down to the category of conservation and extinction. The animals were not only used for draft in agriculture but for manure too. Indiscriminate use of chemical fertilizers has not only reduced the fertility and productivity but also attracting uncurable fatal diseases like cancer. This ill-advised use effecting human and soil health. Now the question of remedy comes and what can be solution to these emerging problems posing threat to agriculture production. Nature has bestowed India with bright sun shine during the summer when the lands are parched needs this type of energy such as wind, solar and biomass which are easily available with farmers without costing much. Renewal energy and agriculture are vanquishing combination for cost. Renewable energy can be used on the farm to replace other fuels or even sold as a cash crop. It is one of the most promising and important opportunities for value-added products in agriculture. Solar energy promising effect on agriculture by saving money, increasing self-reliance and reducing pollution. Solar energy can cut a farm's electricity and heating bills help farmers to increase their profitability. Cheaper and improved technologies are required to modernize the agriculture sector. Most of the on-farm operations earlier were performed either manually or by animal power but the scenario has completely changed. We are competitive with developed country and advancing to self-reliance in agriculture.

The Sun has been worshiped as a life-giver to our planet since ancient times. The industrial ages gave us the understanding of sunlight as an energy source. India is endowed with vast solar energy potential. About 5,000 trillion kWh per year energy is incident over India's land area with most parts receiving 4-7 kWh per sq. m per day. Solar photovoltaics power can effectively be harnessed providing huge scalability in India. Solar also provides the ability to generate power on a distributed basis and enables rapid capacity addition with short lead times. Off-grid decentralized and low-temperature applications will be advantageous from a rural electrification perspective and meeting other energy needs for power and heating and cooling in both rural and urban areas. From an energy security perspective, solar is the most secure of all sources, since it is abundantly available. Theoretically, a small fraction of the total incident solar energy (if captured effectively) can meet the entire country's power requirements (Source www. Mnre.gov.in). The objective of Green Corridor Energy is to synchronize electricity generated through renewal energy to conventional power grids to supply uninterrupted power.

Roof top panels and on field installed panels are common sight in urban and rural areas. The owners are self sufficient in power generation rather adding to the power pool through grid helping others. This new concept is taken very well by Indian Farmers. Now a days renewal energy is integral part of agriculture. Almost every farmer has taken advantage of subsidiary offered by government and symbiotic effect.

Role of renewal energy in agriculture:

For on farm operation farmers are in search of Cheaper and improved sources of solar energy applications for agriculture. Renewal Solar energy is clean, risk-free and is harmless to man and environment. What are those areas agriculture where we can take advantage of this source of energy? These incude:

1.Water Pumping
2. Crop and grain drying
3. Seed Storage
4. Green House heating

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Cotton Seed and Cake Main Ingredient of Animal Feed as Protein Source

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INTRODUCTION

Cotton is an important fibre crop and plays an important role in national economy. Cotton contributes approximately 65% of raw material for textile industry. Over the decades India is practicing cotton cropping but in last few years India recorded significant quantitative and qualitative increase in cotton production. We use to imported lakhs of bales to meet our domestic requirement However, after Government launched special schemes like intensive cotton production programmes through successive five-year plans, that cotton production received the necessary impetus through increase in area and sowing of Hybrid varieties around mid-70s. We are self suffient in cotton production except at occasions of crop failure to white fly attack. Our cotton industry demand of cotton fibre is met with surplus of cotton seed. Since launch of Technology Mission on Cotton by Government of India in February 2000 significant achievements have been made in increasing yield and production through development of high yielding varieties, appropriate transfer of technology, better farm management practices, increased area under cultivation of Bt cotton hybrids etc. All these developments have resulted into a turnaround in cotton production in the country since last 6/7 years. The yield per hectare which was stagnant at about 300 kg/ha for so many years, jumped to 506 kgs in the year 2017-18 and had reached to the level of 566 kgs per hectare in the year 2013-14. Though the per hectare yield is still lower against the world average of about 762 kgs per hectare, the fundamental changes that are taking place in the realm of cotton cultivation in the country, are having the potential to take the current productivity level near to the world average in the near future.

The details regarding area, production and yield in the country for 2018-19 vis-à-vis 2019-20 are given here as under:

Year	Area in lakh hectares	Production in lakh bales	Yield kgs per hectare
2018-19*(P)	126.58	330.00	443
2019-20*(P)	125.84	360.00	486
Source: Cotton Advisory Board P-Provisional *As per CAB meeting 28.11.19			

To make the productivity Indian cotton comparable to other countries like USA and China there is need to give more stress on production of high yielding variety. Hybrids can be best utilizes avoiding hue and cry on BT cotton. There are organizations which are raising voice against BT cotton and their ill effects on feeding to animals without supportive research trials. Protein requirement of animals are essential. Protein deficiencies usually accompany energy deficiencies. They are not usually as severe and take the form of:

1. Reduced appetite in young animals.
2. Lowered feed intake.
3. Lack of muscle development.
4. A prolonged time to reach maturity.
5. In mature animals there is loss of weight and decreased milk production.

For all round development of body of animal, the animal requires the desired or optimal level of nutrients as per their bodily composition and production and reproduction status of animal. The animal needs energy, protein, fat, vitamins and minerals for their growth, maintenance and production. Lack or deficiency in any of these may lead to deficiency disorders. Some are essentially to be a part of their diet while others may be synthesized by rumen microbes.

Protein is essential integral of feed. Feed ingredient that contain more than 18% of their total weight as crude protein are classified as protein feeds. Protein is the primary requirement of young and growing animals. However, it may be secondary to energy needs of adults. Now a days the 80% money in animal husbandry is spent on feed. Proteins are costly vis a vis other feed ingredient. To make animal husbandry a viable and sustainable entrepreneur the balance is to be strike in all the feed inputs. Government has banned the feeding protein of animal origin in the form of fish meal and bone meal. These were the cheaper source being a bye product. Now the only alternative left is either plant origin or non protein nitrogen. Nature has provided us with vast range of flora and fauna which are rich in all the ingredients of animal requirement. These are either in vegetative form or in the form of seed and grains. These seeds and grains are act as nutraceutical and even pharmaceuticals for the animals. Although the majority of protein requirement of animals is met from the fodder consumed in bulk which are not the rich source of protein except in case of leguminous crops. The left-out demand id met from the seeds and cake of soyabean meal, cotton seed meal, groundnut meal, safflower meal, sunflower meal, rapeseed meal, linseed meal, sesamum meal and coconut meal. These are not only the rich source of oil(energy) but also protein. The farmers in specific area feed specific meals as per the easy availability and cost effectiveness. For example, in Malva region of Punjab and cotton belt of Haryana animals are offered ad lib cotton seed after boiling to reduce the effect of gossypol or cotton seed cake is offered to animal after soaking. Although it is very costly protein feed source yet the farmers in the region prefer with the notion that it not only increases milk production but fat contents too. Similarly, in the mustard growing belt mustard cake availability is abundant after extraction of oil for human consumption. This surplus mustard cake is fed to the animals beyond standard limits leading to the fertility problem in in animals. There are different methods of extraction of oils. These methods may affect the nutritive value and occasionally the

digestibility. The cotton seed nuts are to be cracked to improve the digestibility and remove the deleterious effect of gossypol. High temperature and pressure of expellers leads to denaturation of protein and ultimately reduced nutritive value. The high temperature may reduce the chances of ill effect of harmful component present in the seed.

Nutritive value of cotton seed cake depends on the type of method used to expel the oil. Modern machines are available to adjust the level of oil contents in the cakes. Desired temperature and pressure can be adjusted to make the required and desired product of your specification. Earlier expellers tend to denature the protein leading to reduced nutritive value. Protein contents of cotton seed cake vary from 22-42% depending on the methods of extraction applied. Decorticated cotton gives higher percentage of protein in cake and is more valuable to rest. Proximate analysis of cotton seed and cake as follow

Whole cottonseed is high in protein, fat, fiber and energy. This combination of nutrients in one feedstuff is unusual. Whole cottonseed with the lint still attached is white and fuzzy in appearance. It sometimes is called "fuzzy seed," and has the analysis shown below. Whole cottonseed from which the lint has been removed is called delinted seed, is black and smooth in appearance, and tends to be slightly higher in protein and fat than the fuzzy seed. Research at the Universities of California and Pennsylvania has shown that feeding whole cottonseed to milking cows can stimulate higher milk fat test and help maintain milk persistency. It should be fed at the rate of (1.8 to 3.1 kg) per cow per day. Mechanically delinted seed has the same effect as fuzzy seed. Whole cottonseeds do not need to be crushed or processed in any way before feeding.

Typical Analysis Cotton Seed

DM	CP	Fat	Crude Fiber	Neutral Detergent Fiber	Acid Detergent Fiber	Ca	P	TDN	Net Energy
93%	21%	17%	24%	41%	31%	0.14%	0.68%	91%	94.1Mcal /100Ibs

Cottonseed Meal Analysis

Ingredients	CP%	EE%	CF%	NFE%	Ash%	NDF%	ADF%	Lignin%	ME
Decorticated	41	9.2	6.3	37.8	8.2	28	20	6	2.8
Undecorticated	22.8	9.2	24.1	36.6	7.3	53.9	41.2	11.5	2.5

Feeding of cakes in animals is recommended up to 30%. This includes different cakes and cotton seed cake is recommended or included up to 15%. Higher percentage is not cost effective. While formulating the ration for animal's utmost care should be taken and animals should be fed according to their stage like growing, adult, lactating or pregnant. Feed requirements for different stages are different and animals must to fed accordingly to get the optimal output.

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Salinity Problems in Haryana and Its Reclamation Techniques

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INTRODUCTION

Soil salinity is one of the major land degradation problems in Indian agriculture which adversely affects the productivity of agricultural land. In India, saline soils occur in 29,56,809 ha area spread in 12 states and Andaman and Nicobar Islands. Out of which Haryana has approximately 49,157 ha area affected by soil salinity. Most of these soils are limited to areas of low rainfall, brackish sub-soil water and impeded drainage. In Haryana, salinity has tinkered so deeply with economic sustainability in the southern-western districts of Rohtak, Jhajjar, Sirsa, Jind, Bhiwani, Sonepat, Fatehabad and Mewatthat farmers there call themselves the "poor cousins" of those in other districts where the quality of soil and water is better. The problem has affected productivity on more than 3.2 lakh hectares, or around 10% of the total cultivated area in Haryana. Saline soils are those which contain excess neutral salts which are soluble and affect the plant growth adversely. The EC status of saturation extract of these soils are generally more than 4.0 mm hos/cm. Higher the salts in the soil more is the electrical conductivity of soil. Plant growth in saline soils is mainly affected due to the osmotic effect of excess soluble salts which caused reduction in availability of water to the plant roots. Also, some of the compounds present in saline soils like salts of chlorides and sulphates of sodium calcium and magnesium have caused depletion of oxygen thus prove toxic to the plants. Cup shaped topography of Haryana and addition of salts through rain water made the area prone towards salinity. Besides this, increase in saline soil area in Haryana is cause by the movement of subsurface saline water due to a vacuum created by pumping of sweet groundwater in adjoining areas. Out of the 2.96 million hectares affected by salinity in India, around 15% is in Haryana. But due to a long-drawn process, less window of time and lack of machinery, less than 70,000 hectares of saline land has been reclaimed nationally so far. Different methods of reclamation of saline soils include:

Drainage and leaching: In saline soils the salts need to be leached down beyond the root zone and not allowed to come up again. However, presence of high water table prevailing in most salt affected parts of Haryana may creates a limitation in the way of successful accomplishment of leaching of salts. Therefore, some forms of artificial drainage like ditches or pumping from aquifers is provided. In the absence of drainage, efforts should be focused to leach down salts from the soil surface as much below as possible by leaching with good quality of water i.e. canal water. Leaching can be done by ponding water on soil surface. Usually, water table is lowest in the month of May and June so this is the best period to perform leaching. When we have not available with us the good quality of water in sufficient amount then we should go for conjunctive (mixing of good and poor quality water) use of water.

Raising of crops and trees: Some of the crops are more tolerant to saline soils than others, therefore selection of crops in salt affected soils is quite important. Field crops like barley, dhaincha, sugarcane, oats, berseem, cotton and guar can tolerate even 12.0 mmhos/cm of electrical conductivity, while crops like field beans, mung, urd, gram, and sesamum are highly sensitive to salinity (EC<3.0 mmhos/cm). Medium tolerant crop includes wheat, raya, cotton, sorghum, bajra, maize and rice. The vegetables crops which can be grown successfully under high salinity conditions are asparagus, spinach, tomato, potato, sweet potato, carrot, onion, peas and garlic, while radish, celery and green beans are highly sensitive. Reclamation through bio-drainage, by planting of eucalyptus has been achieved in low-lying areas in some blocks of Haryana.

Others techniques: Proper land leveling, smoothening and bunding is the major requirement for reclaiming the salt affected soils while other includes addition of organic amendments like organic waste such as FYM, compost and vermi-compost also proved to be very beneficial.

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Utilization of Agricultural Waste

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INTRODUCTION

Agricultural wastes are the surplus of the different agricultural raw products, which are obtained from the different growing, and the processing agricultural products like vegetables, poultry, fruits, meat, crops, and different dairy products. These wastes are not just the wastage of products but also the wastage of our critical resources like land, labor, fertilizers, and energy. But these products can benefit humans if they are used in the right way. Their benefits are more than the amount of revenue spend on their transportation, collection, and processing. These may be present in solid or liquid forms. Agro-waste is the term used for these kinds of products. The number of tons of agricultural waste is increasing day by day but there is no pattern for their right usage. Pakistan produces a high amount of waste with which they can overcome their electricity shortfall problem. There are different techniques and methods which are used by developed countries to generate electricity from these waste products. Pakistan produces very less amount of its total energy generation by renewable sources which are far less than the developed countries.

Pakistan can overcome the deficiencies in its natural gas and power sector by these practices which are far cheaper than the other ones. As our country is an agricultural country and the recent share of agriculture in Pakistan's GDP is 18.9%. Our agricultural economic sector produces a lot of agricultural waste so, we can utilize this waste in generating electricity. The agricultural waste which our country produces can overcome our electricity demand to a great extent. We need to utilize these resources with the right approach and through effective methods which will help the country's economy.

Pakistan has almost every kind of climate which is favorable for every type of crop production. The tropical climate is the best production climate for most of the weeds, insects, and crops. As the number of insects increases the ratio of attack will increase and most of the crop will destroy and cannot be used for any purpose. But these waste materials can solve one of the biggest issues of Pakistan, the electricity issue through biogas energy plants. Most illiterate farmers waste these crops which can help them in terms of revenue. Biogas is one of the emerging renewable resources for electricity production. Some of the farmers uses solar energy tube wells but most of the farmers in Pakistan use electricity tube wells. By using biomass energy resources developing countries like Pakistan can boost up their economies and ultimately this would help the farmer to reduce his expenses. Farmers can both produce and sell the excessive amount of energy produced by this plant. It is one of the emerging trends in the energy sector which attracts many giants of this sector. Different crop residues and manure are used for cooking and heating in rural areas. There are many biogas plants in our country but these are not enough to overcome this problem. The need of the hour is to focus on this cheap source of energy. We need to educate our farmer that how can he take benefit from this and how can he get revenue by selling this waste. The average expenses on building a bioenergy plant are 52,000-65,000 rupees. The manure of only two cows is enough for a normal household. energy. Also, with this plant excess amount of manure that comes at the second outing of the plant can be used as a fertilizer. Further, it can solve the natural gas issue of Pakistan. The gas produced by the energy biogas plant is far cheaper than this.

Farmers used different crop wastes to feed their animals, like paddy crops byproducts such as rice bran and paddy straw are produced. Farmers usually used paddy straw for making shelter, beds, and for feeding animals. However, they can produce energy from paddy straw and wastes like mustard and cotton sticks. In the same way, wheat straw can be used for making particleboard and different products like hats, briquettes, mats, and different other handicrafts but farmers utilized these for feeding their animals. Sugarcane wastes are bagasse and sugarcane trash. Bagasse can be used as fuel for the production of jaggery. This waste can also be used in the paper, cardboard industry, for the growth of green fodder, and energy generation. Barbojo (sugarcane waste) is also used for energy production. Cotton sticks are one of the best sources for biogas production. However, these can be used in the particleboard, plywood industries, and in power plants which would help the farmer in the form of raising income. By-products of mustard are husk and sticks of mustard. Most of the farmers sell these byproducts to brick industries. It can be used for feeding the animals after ammonia treatment. Briquettes can be made from these sticks. Horticultural crops waste like dead branches, damaged fruits, leaves, and unsold vegetables and fruits are not used in the right way. Farmers used this waste for feeding their animals. But, the methods like drying can preserve these fruits and vegetables for a longer period. Chemicals like lactic acid, citric acid are produced by these waste products. The orange peel which farmers usually did not use in Pakistan, it can serve as an insect repellent, such as aphids and mosquitoes. It helps in increasing the soil acidity and serves as fertilizer too. Similarly, in floriculture, the plants are useless after picking the flowers. Farmers sell these damaged flowers at minimum prices. Some of the farmers used these damaged plants in manuring the field. These flowers can be dried and powdered for the making of dry flowers which is an emerging industry soon. In the same way, the mushroom waste after the harvesting of mushrooms can be used for composting as well as vermicomposting. It can also be used for gardening, nurseries, and growing vegetables for better growth and to enrich the soil. Forestry waste like dead trees and other plant waste like stalk and leaf of banana, leaf of pineapple and stalk and peel of maize from cob are also used for paper formation. In the same way, some of the farmers did not like to use manure as the organic fertilizer which includes many nutrients like nitrogen which helps in the leaf growth and plant color. Most of the farmers used it for dung cakes formation which they used for cooking and other purposes.

Many hazardous gases emit from these dung cakes which affects humans and their smoke affects the atmosphere also. Farmers can use this waste for the production of biogas. Pyrolysis is another method in which the waste is heated at 400-600^{o}C. This reaction takes place in the absence of oxygen and it provides a char that is used for chemical formation and as an energy source.

Pakistan is among the developing countries of the world which have many crises like energy crisis. It affects the agricultural sector as well as the country's economy. But these problems can be solved by using the right techniques and methods such as biogas energy plants which help the country to overcome the energy as well as natural gas crises. Govt. needs to provide awareness

through extension field staff which is directly in contact with the farmers. Different programs like farmer field staff should be launched to aware the farmers. Govt. should learn from the past programs which were ended in a deficit. There should be a proper and direct mechanism for evaluation. Govt. should need to provide small-scale loans on easy terms and conditions to support small scale farmers which they can use for their betterment. A proper supervision should be needed to confirm if these loans are used in a right way. Secondly, they should provide extension field staff with complete knowledge which they can provide through proper training. The need of the hour is to hire new workers in extension field staff. Obviously, the new blood will work with more enthusiasm which would help to fight against old mindsets. Govt. should need to build more biogas plants on a commercial scale which would help them to get rid of the energy crisis and expensive energy sources like oil. Secondarily the role of extension field staff is much more important for the dissemination of information and implementation of these technologies. They should need to persuade the farmers to use these technologies and the utilization of their waste in a better way and how can they earn more profit from it. With this profit, small-scale farmers can build their farms and spend this revenue on fertilizers, on their animals, and the most important of all to raise their living standards

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Emerging Trends of ICTs in Agriculture

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INTRODUCTION

Information and Communication Technology (ICT) is the use of the latest updated innovations to uplift the development of the country along with the lifestyle of people and literacy rate to serve the economy and modern era effectively. ICT includes, Internet, Social Media, Toll-Free Helplines, Webinars, E-marketing, Web-Communication, GIS/RS Technology, Drone Technology, Artificial Gardening, Intelligence, Smart Communication, and Smart Agriculture, etc.

Nowadays modern agriculture technology plays a big role in farming. It is a need of time to educate a farmer to make him use modern agriculture technology making farming easier and affordable too. It is an innovation and emergence in agriculture which is directly related to the literacy of people more the people have literacy rate more will be effectiveness, as it is seen that the developed countries were also suffering from shortage of food as a result of rising population. Developed countries such as China, America, Russia, England, Brazil, Canada and many more countries from the western world have focused on iterating and awarding agricultural community about the innovation by strengthening their agricultural advisory department and policies reform according to circumstances of digital era.

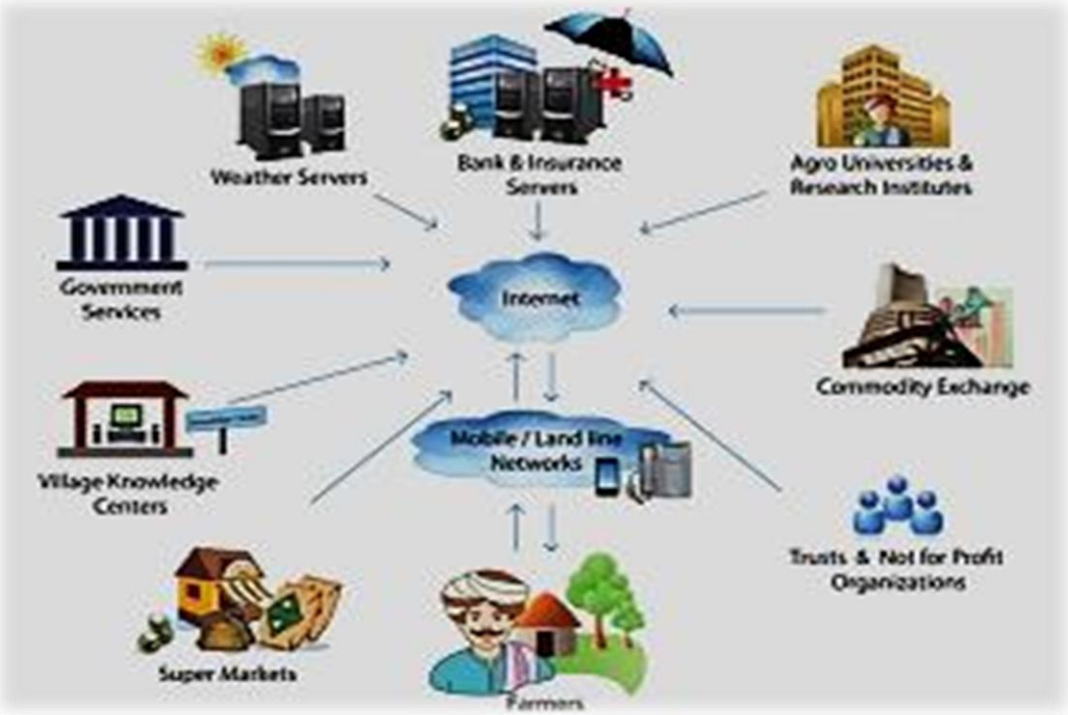
Innovative pathways they are using to meet the modern challenges to agriculture, and strong role of agricultural extension department they also enhanced their trade and lifting upward their life style and turning it in mechanical, scientific robotic lifestyle with more comforts and durability with advancement. However, countries which are under-developed such as Pakistan has comparatively less literacy rate and the economical structure of such countries are not much supportive to innovative adaptation but they compete the market place by managing with debt, loans to implement modern technology to their agriculture and are still relying but competing to emerge with the passage of time. The reforms in the agricultural advisory of developing countries are more slow due to conflicts of interest and many other useless factors they have communication issues still dependent upon the TV Shows, Radio-Telecast, Mobile phones services and are lying a way far to meet the needs of upcoming modern lifestyle due to very less emergence and enhancement in agriculture and less reforms in advisory services but competing emerging and making their stakeholders to assure it is beneficial for their survival they are emerging with passage of time with handsome outcome and uplift to the economy of their country and is also competing for some crops with developed countries.

Soil and crop sensors have been introduced in different developed countries where agriculture is practiced in modern way to fulfill the requirements of modern and upcoming era. These sensors can play a key role in management of farms and proper choose of more favorable conditions for perfect yield of crop. These sensors can measure the nutrient availability, nitrogen leveling water availability of soil, condition of soil, its composition and also the Ph. of soil, where the crop sensors identify that which thing is essential for plant and what is its proper time like fertilizer and manure application, irrigation schedule and allow and stop it automatically whenever needed also help in maintaining level of humidity, preventing erosion of soil resulting in more accurate less and effective use of limited resources. Farming machinery has been developed which is capable of working automatically according to situation and some machines are manual based having revolutionized technology with extra sensitive sensors to sense the correct tillage correct fertilizer spreading maintenance of furrow and

stream correction ploughing and prevention machine and crop from devastating effects and troubles faced due to weather change.

Wavelength management has also been introduced which is an initiative proving beneficial for the modern era with an exceedingly increasing population, this system help farmers, as well as the urban community to raise crops without weather limit just to calculate the correct sunlight requirement according to season and correct wavelength, is needed to grow any of crop in any alternative season, full-spectrum Light bulbs and Light Emitting Diode (LEDs) proved very beneficial for improvement and encouraging modern farming to a new trend to fulfill need based on future. The technology named as Geographical Information System (GIS) by which geography of any land can be seen and measured calculated and can be examined on daily basis just by this system the system introduce relation with satellite view of crop the bird's eye view which is more resolved and well explaining the factual circumstances by which one can keep an eye on his/her land whenever wherever needed. It is also a fact that scientist are taking road to make path for introduction of this technology in crop inland view pests, humidity, and irrigation management just as far as a click.

Pakistan is also a developing country with an agriculture backbone supporting the economy of the country has a strong contribution to Gross Domestic Product (GDP). Due to less economical support, less job creation, and low literacy rate of farmers in Pakistan are still relying on traditional sources because the advisory or information system in Pakistan is not much efficient. The gap in the dissemination of information across the country persists as progressive farmers generally seeking to expand worker communications. The proportion of Extension Field Staff (EFS) is lower than the proportion of farmers and the extension staff is not able to disseminate information to all farmers. There are many variants of sources of information including traditional and modern media, which provides farmers with updated information. More awareness with ICT means more yield. Agricultural extension has a basic role in awaking and fostering the adoption of the latest and up-to-date technologies that enables farmer to make better resolutions in farming.



The most emerging tools of ICTs may include; Television Programs, Mobile Phones, and Radio Telecast, as well as Agriculture based Websites, Toll-free helplines, GIS/RS tech, Artificial Farming, Drone Technology, Webinars, Digital Marketing, are used as communication channels and disseminating information to help out farmers for greater yield using low-cost techniques and without wasting our natural resources badly and to increase their economy share for prosperity of Pakistan. Very less farmers are familiar with the internet-based trends and services. Now the provinces should initiate reforms in the agricultural advisory so that the farmers should be introduced to modern technology, use of remote sensing technique, weather forecasting, artificial gardening and newly introduced departmental based drone technology contributing to the economy of Pakistan with handsome revenue generation.

ICT has great importance in the growth of the country and with innovation; it increases the competition and chances of survival that adopt the criteria for the modern upcoming era. The farming business is completely dependent on nature. In many parts of the developing world, this sector is in danger due to tremendous changes in climate, global warming and many other factors like, low literacy rate and negligence of reforms in the agricultural extension sector is also a barrier in accomplishing a task to emerge ICTs. There is dire need to make farmers aware about benefits of emerging technology and educate them or their young ones so that upcoming generation will be capable of adopting innovative technology such as Drones, GIS/RS and many more, effectively by exploiting less natural resources.

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Management Strategies for Soil Salinity

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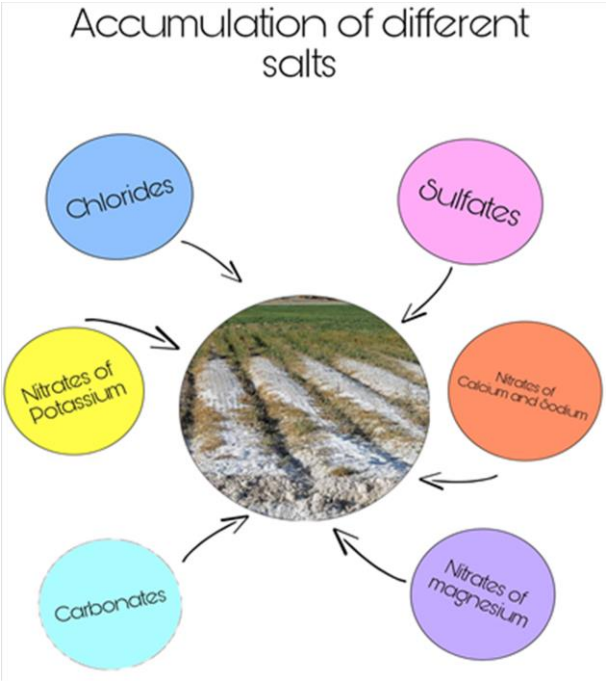
INTRODUCTION

Soil salinity is caused by the accumulation of excess salts in the root zone of the land. This excess salt creates an unbalancing situation among the required salts and nutrients for the crops. Installation of a fine drainage system can cover this problem on a very small percentage, to cover it on a high level with more accuracy there should be proper management. Such soils hold in many kinds of salts such as carbonates, sulfates, chlorides, along with nitrates of magnesium, potassium, calcium, and sodium. There are mostly insoluble in nature and stained whitish on the land surface. The derivation of these salts is due to the utilization of fertilizer and irrigation of crops. To detect the number of salts in the soil there is a way in which current is delivered through the soil, it gives the interpretations in the cast of electrical conductivity (EC). If the capacity of salts is enormous in the soil it will affect the yield of the crop.



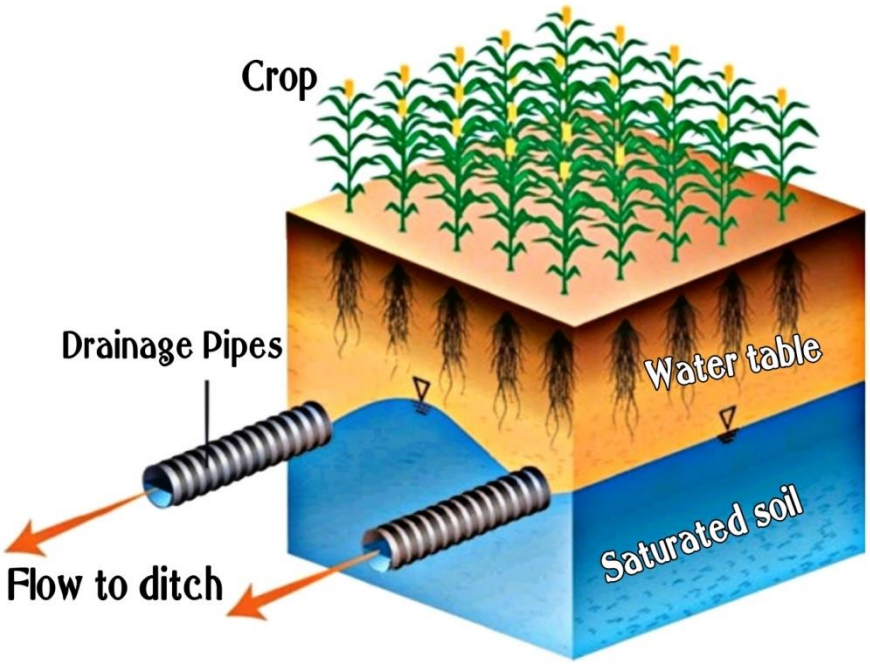
Due to salinity, various crops have contrasting effects on their yield, which limits minor crop damage to the entire decline of the crop. It is a difficult task to fulfill the willing low amount of salts in the soil, as it may be unachievable yet too expensive. Various methods and healing processes may apply to the soil to reduce the level of salts in the soil. Salinity-sensitive crops should not adopt in such high salted areas, however, some salinity tolerated crops can be grown there. The ability to tolerate salinity increases with the growth of plants, they are mostly hypersensitive at the time of evolution and initial seedling phase.

The soil having salinity cannot be rescued by applying fertilizers or chemically correction methods. It can only save by pulling out salts from the root zone of plants. Three methods are there to carry off salinity from the soil. In the first practice, excess salt can be wash out by spreading over the supply of water then the plant's demand. This practice is termed as leaching requirement method. In a next way, the damping condition of soil precept associates leaching requirement method along with false drainage. Last but not least practice of rescuing the soil is to transfer the salts beneath the root zone so they become inadequate to damage the crops. This effective practice is named managed accumulation. In the surface irrigation scheme, excess and improper amount of water results in washing out of salts, but if water is limited then it may leave salts behind on the soil profile. To apply more amount of water than needed irrigation, surface irrigators should analyze the leaching demand of the land. In the act of implementation of plenty of water, the basic nutrients from the soil and pesticides also wash out along excess salts. Leaching should be practice on leading times when the growing season is up, on a reserved basis with immense water quality. Depthless groundwater level surface faces more salinity than deep-seated groundwater level. At germination and seedling, phase maximum crop plants cannot carry salinity stress. After passing these initial stages, a mature plant can tolerate a high capacity of salts. Harvest time may consider the best time for the leaching process on large scale, as nutrients are pinch down to the ground, it will help in further crop germination. Leaching practice should be aiming at keeping in view the groundwater, drainage, and soil and irrigation system of that specific field.

To apply an excess amount of water in surface irrigation is an easy task, but in the case of sprinkler irrigation, it is quite difficult to control soil salinity by the leaching process. For better results, farmers should supervise the salt level of irrigation water and the EC value of the soil. Whenever the leaching process is done the salt, sensitive crops can be grown as part of the rotational pattern. With the passage of time salts start to assemble in the root zone, extra salinity tolerant crops should be grown there. Leaching practice should be at end of the crop rotation pattern. A crop rotation sample is pinto beans, corn, wheat, and barley.

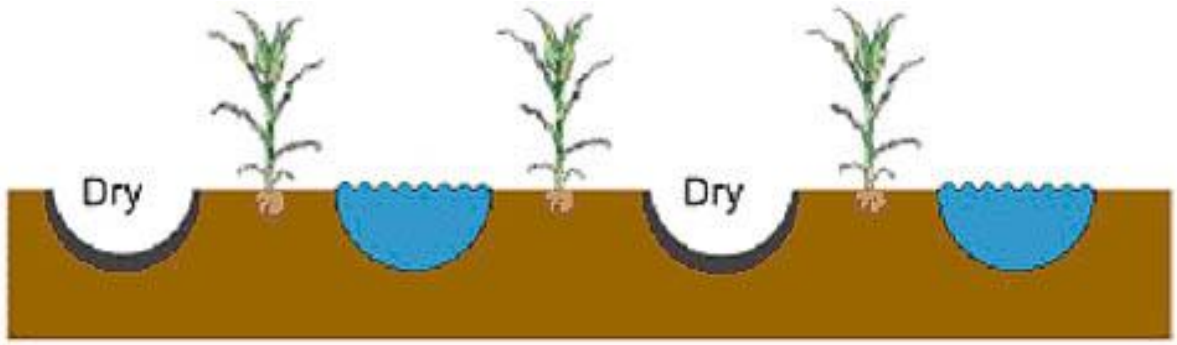
The areas that have upper water tables may restrict the leaching process, to overcome the problem there is a way of artificial drainage. For this purpose, trim the drainage channels under the groundwater table and allow salts to drain out with water from the soil. In another way, plastic drainage pipes can spread under the soil to leach out the salts. For better results, the scheme and assembly of the drainage system should be operated by professional persons, as it can be a tricky task. You should also keep an eye on, clearance of drainage water. Routine discharge of wastes and water will cause problems and to cover this, it may cost high. An artificial drainage

system is beneficial for the farmer who has availability of immense quality and low salinity level in irrigation water, to drain out the excess amount of salts from the soil. This practice will not perform accurately if the soil will not get wet properly, because water will not drain. After completing this process, leaching practice can be performed. In intermittent ponding, various practices are performed instead of a single large one, which utilizes less amount of water.



To reduce salinity there is another method except for leaching, in which salts can transfer to areas other than the initial root zone with the help of satisfied crop bedding and surface irrigation. The basic purpose of this method is to protect the plant's roots and initial seedling stages from excess salts. In case of uneven dispersal of water, salts will accumulate in root zones and areas of seed germination that causes slow growth and even plant death. In a double row bed, structure homogenous irrigation is a demand to leave the sides free from adverse salinity level. Without the constant practice of water in bed systems, salts can collect at one of the furrows more than the other. For single-row bed systems, replacement of furrow in irrigation can be required to practice irrigation in particular furrow leaving behind the other furrow dry. In this way, salts can through to the area of the dry furrow. It is an attentive task to make sure enough supply of water in planted area to protect it from the accumulation of salts. Although it is a dangerous practice of removing salts because in case of heavy rainfall dry furrows contain salts can fill up with water and this mixture can push back salts towards the planted area. This problem can also happen if dry furrows are irrigated by mistake. The remaining crops cover the surface and protect it from evaporation, through which salts cannot show upward movement towards the root zone. Bare soil faces more quantity of salts due to heavy evaporation. To slow down evaporation, the field should be cover by 50 to 30 percent of the debris of crops. Due to these crop residues surface remain wet, this becomes more beneficial during winter rainfalls in leaching soil to protect seedling areas. In the drip irrigation method plastic mulches are used which, lessons the concentration of salts from evaporation. As some plants are very sensitive to salinity in their germination stages, so to

protect them we can use high-quality good water before the season. This water should fill the upper part of soil up to 12 inches to leach all the salts from this area. If we provide immense repetition of irrigation salts will leach out more accurately. By maintaining a high soil moisture level in between irrigations, salts will dilute in the root zone it will become less harmful. In Pakistan, flood or furrow systems are the most commonly used methods of irrigation. These methods are not able to control usage of water up to three or four inches, which is not suitable for the rescue of saline soil. Recommended methods for this purpose are sprinkler structures especially center pivot and linear move structures arranged with low energy precision application (LEPA), nozzle kit or separated drop nozzle, and irrigation through a drip. These methods give outstanding control to hold such kind of salinity. In arid and semi-arid areas, irrigation is necessary for the crops, which mostly comes with salinity problems. The excess amount of salts depends upon the local climatic conditions and the number of salts mixed with irrigated water. To manipulate soil salinity for the elongation of field productivity, we should manage soil moisture, irrigation strategies, and drainages. At last, we should select the right kind of crop according to the salinity conditions of the soil.



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Amelioration of Salt Affected Soils for Enhancing Crop Productivity

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INTRODUCTION

Soils with high concentrations of soluble salts in their profiles such that these salts have negative impact on crop production. Majority of the salts are composed of chlorides (Cl^-), sulphates (SO_4^{2-}), carbonates (CO_3^{2-}) and bicarbonates (HCO_3^-) of calcium (Ca^{2+}), magnesium (Mg^{2+}) and sodium (Na^+). Salt-affected soils may be found on every continent and in almost every climate. In comparison to tropical areas, their distribution is comparatively more widespread in drier regions. Long-term solutions include an understanding of the underlying causes of salt-affected soils and their classification based on physical and chemical characteristics.

Extent of problem

Indian scenario

The extent and distribution of salt affected areas in India according to Central Soil Salinity Research Institute (2012) has been shown in Table 1. In India, salt stress has a detrimental impact on around 6.74 million hectares of soil. The presence of high levels of salt in the soils of many states, including Uttar Pradesh, Gujarat, and Andhra Pradesh, has a significant effect.

Table 1. Extent of salt affected soils in India

States	Saline soils	Alkali soils	Coastal saline	Total
	(ha)			
Andhra Pradesh	0	196609	77598	274207
A & N islands	0	0	77000	77000
Bihar	47301	105852	0	153153
Gujarat	1218255	541430	462315	2222000
Haryana	49157	183399	0	232556
J & k	0	17500	0	17500
Karnataka	1307	148136	586	150029
Kerala	0	0	20000	20000
Maharashtra	177093	422670	6996	606759
Madhya Pradesh	0	139720	0	139720
Orissa	0	0	147138	147138
Punjab	0	151717	0	151717
Rajasthan	195571	179371	0	374942
Tamil Nadu	0	354784	13231	368015
Uttar Pradesh	219890	1346971	0	1368960
West Bengal	0	0	441272	441272
Total	**1710673**	**3788159**	**1246136**	**6744968**

(CSSRI, 2012)

Formation of salt affected soils

Depending on the source of origin, salinity is classified as primary or secondary. The former is influenced by natural salt deposits, while the latter is mostly caused by anthropogenic causes.

Primary salinization

It is mainly due to the following:

- ✓ Rocks' weathering
- ✓ Capillary rise due to shallow groundwater
- ✓ Intermixing of sea water in coastal lines
- ✓ Salt loaded sand carried by sea winds

Secondary salinization

It is caused due to the following:

- ✓ Irrigation water of poor quality
- ✓ Industrial effluents
- ✓ Indiscriminate of basic fertilizers
- ✓ Flooding with salty water

Classification of salt affected soil

Two major groups of salt-affected soils have been identified on the basis of information about their existence, characteristics, and plant growth relations:

Saline soils - Development of most agricultural crops is hampered by the presence of neutral soluble salts in saline soil, the most common of which are sodium chloride and sodium sulphate salts. However, saline soils also have significant amounts of chlorides and sulphates salts of calcium and magnesium.

Sodic soils - Sodic soils contains sodium salts, especially, Na_2CO_3 that on alkaline hydrolysis lead to raise in pH of such soils.

Table 2. Chemical characteristics of saline and sodic soils (Indian classification)

Class	EC_e (dS m^{-1})	pH	ESP (%)	$Na^+/ [Cl^-] + [SO_4^{2-}]$
Saline	>4	<8.2	<15	<1
Alkali	<4	>8.2	>15	>1

Gupta and Abrol (1990)

The effects of excess salts on different properties of soil

Physical properties

High levels of exchangeable Na+ in salt-affected soils cause structural degradation, resulting in low porosity and poor soil-water and soil-air interrelationships. It also has an effect on hydraulic properties that include hydraulic conductivity and rate of infiltration in the soils, primarily as a result of aggregate breakdown. Slaking, clay swelling, and dispersion are the key processes that are involved in aggregate losses in sodic soils. Though swelling is a reversible process, dispersion is an irreversible one that can induce individual soil particles to translocate and, as a consequence, permanently obstruct water transmitting pores. Massive structure, poor aeration, and waterlogging will occur as consequences of degradation of soil structure and a decrease inability in soils to transmit water and air. Plant establishment and development are hampered by such factors.

Chemical properties

Salt-affected soils generally suffer from deficiencies of macro-nutrients such as NPK. However, higher pH reduces availability of iron, zinc, manganese, aluminum and copper Lower carbon inputs and further degradation of their physico-chemical properties result from decreased vegetation growth caused by higher salt concentration and osmotic pressure. Surface crusting is responsible for lower organic matter due to erosion. High ion concentration of sodium (Na^+) and chloride (Cl^-) results in exosmosis affecting the plant cells and growth.

Biological properties

Increased soil salinity causing osmotic stress and loss of water from microbial cells, has a negative effect on microbial activities. Additionally, there is also Na^+ toxicity along with carbonates, bicarbonates and chlorides causing deficiency of Ca^{2+} and organic matter losses due to structural degradation which are

all responsible for lower microbial population and their activities in such soils.

Amelioration and management strategies

Management refers all the processes of protecting soil and improving its performances. The following are some of the methods for reclaiming salt-affected soils.:

Physical methods:

Scraping

Temporary soil reclamation process in which t he salt layer on the soil surface is mechanicall y scraped off and the lower layer of soil with l ess salt concentration is used for cultivation.

Flushing

Water is used to wash away the salts accumulating on the surface.

Leaching

The most common method of leaching is ponding fresh water on surface of the soil and allow it to penetrate. As salty drainage water is drained via subsurface drains, the leached salts are carried away from the reclamation area and leaching is considered as successful.

Chemical methods

1. **Use of soluble salts of calcium**
   - ✓ Gypsum ($CaSO_4.2H_2O$)
   - ✓ $CaCl_2$
   - ✓ Phospho-gypsum
2. **Use of sparingly soluble calcium salts - $CaCO_3$**
3. **Use of acid or acid forming materials**
   - ✓ Sulfur
   - ✓ Sulfuric acid
   - ✓ Sulfates of iron and aluminum
   - ✓ Pyrites (FeS_2)

Increasing dose of sulphur positively correlates with increasing rice yield and wheat yield. Similarly using green manures can also be used for amelioration of salt affected soils along with chemical amendments.

Advance Method of Amelioration of Salt Affected Soil

Many advance methods of amelioration of salt affected soil like as –

1. Municipal solid waste
2. Use of bio-char
3. Use of nanotechnology

Municipal solid waste (MSW): The application of anaerobically decomposed MSW improves the soil chemical properties by decreasing the pH, SAR and $CaCO_3$, and increasing the organic matter and cation exchange capacity (CEC). The ameliorative effect may probably be due to deprotonation of fulvic and humic acids, leading to formation of organic poly-anions. That can bind clay particles to form micro-aggregates by developing [(Cl-P-OM) x] y compounds, where Cl, OM and P, are clay particles, organic matter and polyvalent cations. Organic ameliorants, on the other hand, enrich the soil with stable OM with higher cation exchange capacity and aggregation, and are more efficient in removing Na^+ from the upper soil depth due to increased leaching.

Use of bio-char: In salt-affected agricultural land, biochar compost in combination with pyroligneous solution from wheat straw can be an effective choice for reducing salt stress and increasing crop productivity. Biochar has a more porous structure and a huge surface area, which can greatly increase the soil's water holding capacity. The use of biochar as the primary component of the compost can contribute to enhance the elimination of soluble salts. Furthermore, biochar-amended soil can form a blocky structure, preventing salt from moving upward with capillary water.

Use of nanotechnology: Nano-gypsum has a large surface area for exchanging adsorbed ions, which increases gypsum's ameliorative properties. Soil treated with nano-gypsum will accumulate more Ca^{2+} in the exchange complex than soil treated with traditional gypsum. Nano-major gypsum's impact may be due to its finer particle size, higher CEC and solubility.

CONCLUSION

For reclamation of salt affected soil the new techniques can be more efficient and cost inexpensive, some of techniques are also save the environment from toxic waste material by converting into as a economic amendment. These techniques not only improve the physio-chemical properties but also increase the crop productivity, organic matter and soil fertility.

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Important Efforts by Public Sector, Private Sector and NGOs in ICTs for Rural area Development in India

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INTRODUCTION

Important efforts by public sector, NGOs and private sector in ICT for rural area India are:

- Cyber extension program of MANAGE (http://www.manage.gov.in/)
- National Informatics Centre (NIC) (http://home.nic.in)
- DACNET (http://dacnet.nic.in)
- Community Information Centre (CIC) (http://www.cic.nic.in/)
- Warna Wired Village Project (http://www.mah.nic.in/warana)
- Bhoomi (http://www.bhoomi.kar.nic.in/
- e-Seva (http://www.esevaonline.com)
- http://ruralinformatics.nic.in/
- N-Logue- http://www.n-logue.co.in/home.htm
- http://edevelopment.media.mit.edu/SARI/mainsari.html
- http://www.tenet.res.in/cordect/cordect.html
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- http://www.gyandoot.net/
- http://himachal.nic.in/lokmitra/lokmitra_hdr.htm
- http://setu.maharashtra.gov.in/
- http://www.agmarketnet.nic.in
- http://www.itcportal.com/sets/agreeex_frameset.htm
- http://www.oddanchatrammaket.com/
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- http://www.tatatkk.com/kisan_kendra.htm
- http://www.manage.gov.in/
- http://www.nddb.org/
- http://www.isapindia.org/
- http://www.mssrf.org/
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Integrated Nutrient Management and Soil Fertility

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INTRODUCTION

The intensification of agricultural production and productivity necessitates the increased rate of nutrient application and current fertilizer production levels are insufficient to meet the entire plant nutrient requirement. At present the gap of 10 million tons is likely to widen further in view of higher prices of diammonium phosphate (DAP), potash and other nutrients. Moreover, long term trials on integrated nutrient management (INM) revealed that neither inorganics nor the organics alone can achieve sustained production under intensified cropping. The interactive advantage of conjoint application of organic and inorganic sources of nutrients in INM have proved better than single source of nutrients.

INM is the best way to get optimized benefits from all sources of plant nutrients in an integrated manner for maintaining soil fertility and nutrient supply for plant at any optimum level for sustaining desired crop productivity. INM is not a new concept, but an old-time practice when almost all the nutrients need were met through organic resources only to supply secondary and micro- nutrients besides primary nutrients. The major concept of integrated nutrient management is maintaining and improving the soil fertility through integrating different nutrient resources along with fertilizers for sustaining crop productivity on long term basis.

Major components of INM are

1. Integration of crops with green manures and legumes which help to restore the soil fertility
2. Balanced application of fertilizer nutrients to achieve yield.
3. Application of organic manures like FYM, compost, vermicompost, biogas slurry, press mud and poultry manures.
4. Use of biofertilizers.
5. Recycling of crop residues.

Fertilizers: Fertilizers play a vital role in INM. The dependence on fertilizers has been increasing due to poorly managed organic resources and increasing depletion of soil fertility. The fertilizers used are not only indiscriminate but imbalanced also. In Haryana, farmers are using excessive nitrogen through urea, whereas depletion of nutrients such as phosphorus, potassium and micro-nutrients is increasing. In India at present, more than nine major and micro-nutrients are deficient. Efficient use of fertilizer nutrients by the crop needs proper attention based on crops to be grown, available nutrient status and fertilizer use on soil test basis. Use of fertilizers conjointly with organic sources will increase nutrient use efficiency (NUE). Enhancing NUE should therefore, be a priority area for improvement of soil health and to economize the crop production.

Organic Manures: Organic manures such as farm yard manure (FYM), crop residues, city waste, press mud, vermicompost and other agricultural wastes have large potential for providing nutrients. There are various other industrial byproducts like nonedible oil cakes and wastes which if properly evaluated can be a good source of nutrients along with their favorable effects on soil properties. (**Table 1**). These organic manures not only provide all essential nutrients but also improve soil physico-chemical and biological properties of the soil.

Table 1. Nutrient status of some organic sources, FYM, compost, cakes and residues

Name	Source	Nutrient content (%)		
		N	P_2O_5	K_2O
Animal Wastes	Cattle dung	0.3-0.4	0.10-0.15	0.15-0.20
	Cattle urine	0.80	0.01-0.02	0.50-0.70
FYM Composts	Farm Yard Manures	0.5-1	0.15-0.20	0.5-0.6
	Poultry manure	2.87	1.0	1.5
	City compost	1.5-2.0	1.0	1.5
Oil Cakes	Castor	5.5-5.8	1.8	1.0
	Neem	5.2	1.0	1.4
	Rapeseed	5.1	1.8	1.0
	Linseed	5.5	1.4	1.2
	Sesame	6.2	2.0	1.2
Animal meals	Blood	10-12	1.2	1.0
	Meat	10.5	2.5	0.5
	Fish	4-10	3-9	1.8

Green Manuring and Legumes: These crops are known for soil fertility restorers due to their potential to fix atmospheric nitrogen (N_2) in root nodules of legume crops in symbiosis with rhizobium bacteria. Legumes can play a greater role in INM when included in cropping system. Green manure crops like dhaincha (*Sesbania aculeata*) in paddy-wheat cropping sequence can be a boon to the farmers as Department of Agriculture, Government of Haryana is providing 90 % subsidy on dhaincha seed for enhancing soil fertility, thus soil health. Introduction of crop rotation or legumes in rotation improve soil health along with save underground water. Crops like gram, lentil, moong, sun hemp, dhaincha, methi, berseem. Cowpea are very good restorers of soil fertility besides natural resource conservation.

Bio-fertilizers: Bio-fertilizers play a significant role in improving soil fertility and boosting crop productivity due to their capacity to fix atmospheric nitrogen, solubilize or mobilize phosphorus in symbiotic and non-symbiotic ways in root nodules. Bio-fertilizer like rhizobium in pulses and azotobacter and azospirillum in non-legumes are widely known for nitrogen addition to the soil, whereas phosphate solubilizing bacteria (PSB), phosphotika help in phosphorus solubilization. These bio-fertilizers impart soil fertility buildup in the long run. These are easy, economical and cost effective. These may be used as seed treatment, root dipping or soil treatment but seed treatment is the best method. At present, these are available in liquid form which are available at Department of Microbiology, Chaudhary Charan Singh Haryana Agricultural University, Hisar, IFFCO & KRIBHCO sale centers at district level. Other biofertilizers like BGA (Blue Green Algae), Azolla, VAM needs to be evaluated for their response in different agroclimatic conditions in different crops. In Haryana, rhizobium, azotobacter, phosphotika is being used but there is urgent need to popularize in all crops to make a dent in INM on long term basis.

Crop Residues: Management of crop residues is one of the critical issues in Haryana and Punjab due to their role in environmental pollution as crop residues left in the fields after combine harvesting of wheat and paddy are burnt. A large amount of nutrients is lost resulting in depletion in soil fertility due to loss of organic matter and micro-organisms. Recycling of these residue back to fields help to build organic matter in the soil to sustain soil heath. Use of new generation technology machine like Happy Seeder for sowing of wheat in standing crop residues remaining after combine harvesting of paddy have resulted in excellent wheat crop besides controlling population and resource conservation. Burning of crop residue results in loss of biomass and plant nutrients resulting in deterioration of soil fertility and soil health. Burning must be avoided at any cost to save soil fertility.

Thus, INM facilitates the implementation of plant nutrition and soil fertility management practices in farming systems, using both organic and inorganic sources to meet food production demands. All of the sources must be properly handled to achieve the highest degree of performance. It regulates the overall management of the farming system, including cattle, poultry, animals, and plants. The advantage of INM can be restoration and sustaining soil health, prevention of macro and micro-nutrient deficiencies, enhancing fertilizer or nutrient use efficiency and favorable effect on physico-chemical and biological health of the soil. INM is ecological, social and economically viable and environment friendly technique which must be practiced by farmers to sustain soil fertility along with soil health to meet continuously growing demand of food production.

CONCLUSION

In present days, crop residues recycling and organic farming have been recognized as efficient mean for sustaining soil health and environmental quality. However, due to its limited availability, INM is gaining immense importance, not just to attain higher productivity but in achieving maximum stability in crop production under intensive farming systems.

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Hurdle Technology in Food Processing

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INTRODUCTION

Hurdle Technology is a type food processing technique in which all the pathogens in food products can be controlled or completely eliminated so that the final food products will be safer with extended shelf-life. In this technique, more than one approach (hurdles) are combined which forfend microbial safety and stability as well as organoleptic and nutritional quality and economic viability of food products (Alasalvar., 2010). Examples of the hurdles are High acidity, low water activity or redox potential, high temperature while processing, low temperature while storage or the presence of preservatives. The aim is to abolish, halt, or impede the microorganisms that are undesired in the food products.

Principle of Hurdle Technology

Homeostasis of microorganism is disrupted by Preservative factors or hurdles. Microorganisms should not be able to "jump over" all the hurdles present in the food. Preservative factors impede microorganisms' proliferation and make them to remain inactive or even die. The concept of hurdle emphasizes that complex interactions of temperature, water activity, pH etc. are significant to the microbial stability (Leistner., 1992).

Physical Hurdles applicable in Food Processing

Electromagnetic energy (microwave, radio frequency, pulsed magnetic fields, high electric fields), high temperatures (sterilization, blanching, pasteurization, baking, extrusion, frying evaporation), aseptic packaging, ionizing radiation, low temperature (freezing chilling), modified atmospheres, packaging films (including active packaging, edible coatings), photodynamic inactivation, ultrasonication, ultra-high pressures, ultraviolet radiation (Ohlsson and Bengtsson et al., 2002).

Physicochemical Hurdles applicable in Food Processing

Ethanol, Carbon dioxide, lacto peroxidase, low pH, low redox potential, lactic acid, low water activity, Maillard reaction products, organic acids, phenols, oxygen, ozone, phosphates, salt, sodium nitrite/nitrate, smoking, sodium or potassium sulphite, herbs and spices, surface treatment agents (Ohlsson and Bengtsson et al., 2002).

Biological Hurdles applicable in Food Processing

Microbial, bacteriocins, antibiotics, competitive flora, protective cultures (Ohlsson and Bengtsson et al., 2002).

Mechanism of Hurdle Technology

Some recent researches in hurdle technology is done on homeostasis, metabolic exhaustion, and stress reactions of the microorganisms and the novel concept of multi-target preservation is introduced which is gentle but most effective preservation of hurdle technology in foods.

Homeostasis: It is defined as steadiness and firmness of the internal States of organisms. The pH maintenance is necessary. And the fact is, the microorganisms will not multiply if their homeostasis is disturbed, they will remain in lag phase or even perished before the homeostasis is restored (Leistner et al., 2000). This can be done by applying preservative factors (hurdles). This can be done for a short period or permanently to preserve food.

Metabolic Exhaustion: By this auto sterilization of foods is achieved (Leistner et al., 2000). The spore count in stable hurdle technology starts decreasing due to storage at ambient temperature of food products. Vegetative microorganisms will die and if the stability is close to threshold for growth, elevated storage temperatures, presence of antimicrobial and sub lethally injured microorganisms, they die more rapidly. Apparently, microorganisms became metabolically exhausted because of hostile environment created by stable hurdle technology which strain every possible repair mechanism for their homeostasis and leads to an auto sterilization. This auto sterilized food is microbiologically stable, safer during storage, especially at ambient temperature.

Stress Reactions: stress shock proteins generated by Bacteria which is induced by pH, aw, heat, oxidative compounds, ethanol, etc. and they became more resistant or toxic and lethal under stress by starvation by this they create an obstruction in food preservation and can became a serious problem for the process of hurdle technology. So by Multiple target preservation synthesis of stress shock proteins can be forbidden or it will harm the microbial safety and stability of hurdle technology foods. (Leistner et al., 2000).

Multitarget preservation: Concept of Multitarget preservation is introduced by Leistner (1995) to provide most effective preservation of foods. Combining different hurdles is more effective and competent and it will hinder microbial stability as well a synergistic effect could be achieved. They will act synergistically if the hurdles in a food hit, different targets (Eg. Cell membrane, DNA, enzyme system, pH), at same time and by disturbing the homeostasis of the microorganisms multitarget preservation is achieved. This makes activation of stress shock proteins as well as the repair of homeostasis more difficult therefore, employing different hurdles simultaneously in the preservation of a particular food will lead to optimal microbial stability so we should apply different hurdle of small intensity instead of large hurdle of big intensity (Leistner et al., 2000).

CONCLUSION

This article highlights one of the best possible food preservation techniques i.e. hurdle technology. The application of this techniques is based on the Physiological responses of microorganisms during preservation (i.e their homeostasis, stress reactions and metabolic exhaustion). Homeostasis disturbance play's a major role. Stress reaction may complicate the preservation so multi-target preservation is

used to achieve the novel and determined goal by applying synergistic effect. Metabolic exhaustion could boost food preservation of stable hurdle technology foods so a set of hurdle should be applied for the better results in preserving food.

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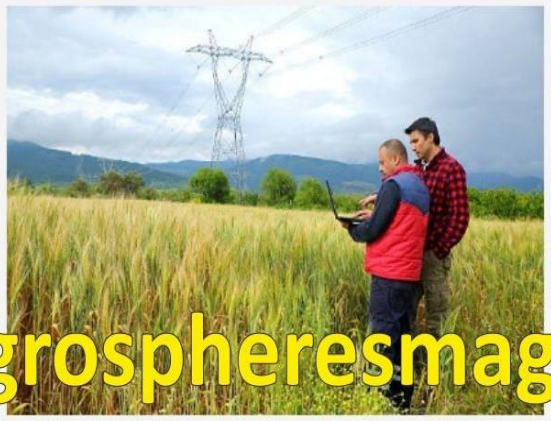

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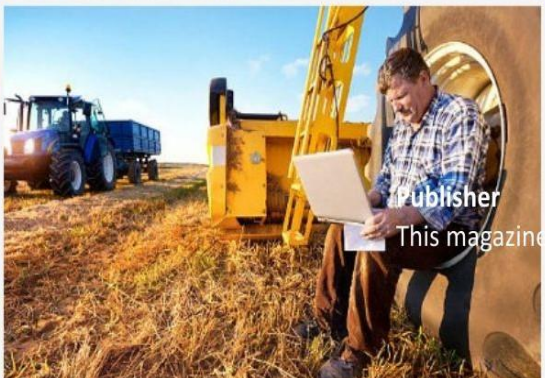

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