

PROGRESSIVE

FARMING

JULY 2023

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A MONTHLY JOURNAL OF PUNJAB AGRICULTURAL UNIVERSITY



PROGRESSIVE FARMING

VOLUME 59

NUMBER 07

July 2023

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Plant Protection plays a significant role to maintain sustainable yields and it combines products and strategies that protect against different pests including insects, weeds, plant diseases, and other organisms that cause damage to crops. It is inevitable that pests infect or attack crops and plants would not produce expected yields of high quality unless they are kept healthy. As per Food and Agriculture Organization (FAO) estimates, up to 40% of global agricultural production is lost to pests annually. These losses not only threaten food security, but also have the potential to limit food access due to unavailability or price increases. Punjab being an agrarian state, the plant protection discipline holds much significance and PAU, Ludhiana has developed different plant protection technologies including seed treatment, nursery treatment, bio pesticides, bio-control agents, traps, spray technologies, ETLs (Economic threshold level) and development of disease resistant varieties to protect the crops at farmer's fields. Chemical control remained major component of pest control strategy, but non-judicious use has led to many problems including insect resistance, insect resurgence and residues. In recent years the major focus is to develop eco-friendly plant protection technologies, so that farmers can maximize their yield without having adverse effect on environment. This special issue on "Plant Protection" will be useful to the farmers for identification and effective management of the pests.

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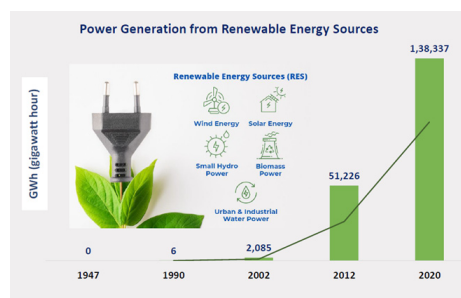
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Renewable energy: A key for improving farmer's income

DR V P SETHI , Head, Department of Mechanical Engineering
DR S S GOSAL, Vice Chancellor, Punjab Agricultural University

Renewable energy and the agriculture sector can be a winning combination that can solve many problems that we face today. It can also be a new channel that can help in improving the quality of agricultural yields, cutting overhead costs and improving the efficiency of agricultural processes.

Keeping in mind the sustainable development goals, India's power generation mix is rapidly shifting towards a more significant share of renewable energy. Today, India is the world's third largest producer of renewable energy, with 40 per cent of its installed electricity capacity coming from non-fossil fuel sources. Renewable energy is natural energy produced through sunlight and wind. Solar, wind, geothermal, hydro and biomass are common sources of renewable energy.



Source: Press Information Bureau, MNRE, Government of India

Solar Energy (SE) is important renewable energy source and can be converted into heat, mechanical energy and electricity. The most applied technologies and applications of SE are; photovoltaic (PV) driven pumps for irrigation, crops, drying of fruits/spices, ice making and cold storage (through absorption or heat driven refrigeration). Micro Hydro Energy (MHE) can be converted into mechanical energy and electricity. The MHE can be directly used in mills, grinding and in

electrical motor for processing. Biomass Energy (BE) can be converted into heat, electricity, liquid bio-fuels and biogas. The BE can be used in dryer (fruits, herbs and spices); combustion motor or electric motor (fuels like ethanol and biodiesel for transportation); anaerobic digester: biogas for lighting, cooking and heating; and industrial biogas for decentralized electricity. Biomass is an organic material used to generate electricity, to produce heat or biofuels for transportation. Bioenergy is derived from wood, agricultural crops, residues, animal by-products and agro-industrial by-products. Punjab produces about 185 lakh tonnes of paddy straw every year. Nearly half of it is managed with *in-situ* (mixing the residue in the soil) and *ex-situ* (used as fuel) methods and rest is set ablaze. There is a huge scope of using the paddy straw bales in the 11 privately owned biomass plants, consuming about 8.8 lakh tonne of paddy straw, to increase farmer's income. There is a vast scope of installing new such units for more paddy straw consumption. A concrete policy by the Government is required by fixing the cost of bales and lifting charges so that farmers save some money out of the whole process. These thermal power plants can also use stubble pellets as 5-10 per cent of its total fuel consumption. Entrepreneurs or progressive farmers with the support of the government can install pellet units to earn extra income for both. Seven other industrial units

manufacturing paper, cement, sugar and edible oil are also using stubble as a fuel with 3 lakh tonne consumption. More such industrial units need to be set up for managing more paddy straw with a view to earn extra income. Overall it can be ascertained that the state needs an infrastructural push to switch to *ex-situ* methods such as more biomass-based power plants, pellets making industry, bio-CNG plants along with faster and attractive transportation to evacuate stubble from the farms and storage godowns for off season use of stubble.

One estimate shows that about 80-90 per cent of country's irrigation is through groundwater. The demand is being met through 12 million electricity connections and 9 million diesel pumps sets to extract underground water for irrigation use. The government policy has set a target of generating 450 GW of energy through renewable energy by 2030. Use of solar pumps for irrigation purposes have now become a cost effective source of power for long term at negligible cost besides cutting down the diesel cost and mitigating the pollution caused by smoke. Currently, use of solar pumps have become a viable option of farmers and an estimate shows that these can save 4 billion litres of diesel annually and 5 per cent of total greenhouse gas emissions. The installation of ground based solar energy power plants on uncultivable under-utilized land can provide a consistent source of income



for at least 20-25 years. The generated electricity from these solar agri-feeders can reduce the agricultural subsidy and infrastructural costs. The solarisation of agriculture pumps offers an additional advantage to the farmers. Through grid-connected pumps, farmers can sell surplus power back to the grid, creating secondary source of income.

Other additional source of income for farmers is from un-utilised organic waste as farmers produce the raw material required for bio-fuel production in biomass

based cogeneration plants that utilise sugarcane and its by-products, surplus rice, maize, damaged food grains and non-edible seeds to produce biodiesel and ethanol. The blending of petrol and diesel with bio-fuels can further mitigate the emissions as burning of agricultural residue will reduce.

With the advancement in R & D of Photovoltaic (PV) technology and solar industrialization, the cost of implementing and managing solar energy setup has decreased tremendously, enabling more PV installations across different applications in the agricultural sector such as; solar water pumping systems; solar powered water and space heating for livestock and dairy operations have specific space and water heating requirements around the year at different seasons; solar powered crop and grain drying systems; solar powered greenhouse heating and lighting

systems. By employing these systems, farmers can easily save costs incurred on electricity bills or indirect earning. A solar greenhouse has matching capacity solar panels to collect the energy and batteries to store the energy. Remote supply of electricity using solar PV systems is employed in the farms to produce the required electricity that is stored in the batteries and used when required. This not only helps in reducing the power consumption from the electricity supply but also saves money for farmers in the long run. Solar-powered cooling systems use refrigeration effect for a continuous supply of power from the batteries connected to the solar panels where the power is supplied directly in the morning and the backup power stored is supplied during the night. With the right implementation, a solar energy setup can be very rewarding in the long run.

New early varieties of sweet oranges: Vaniglia Sanguigno and Early Gold

ANIL KUMAR KAMRA, ANIL KUMAR SANGWAN AND TANJEET SINGH CHAHAL

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In Punjab, citrus is a major fruit crop and occupies more than 53 per cent of the total area under fruit crops. The citrus is predominantly occupied by *Kinnow* mandarin which covers more than 90 per cent of the total area under citrus. The monoculture of *Kinnow* mandarin sometimes resulted into heavy losses in terms of returns to the fruit growers due to glut in the market. Furthermore, *Kinnow* mandarin cannot be processed for juices due to bitterness developed in juice during the processing. The demand of sweet orange juices as tetra pack and fresh juice is increasing day by day. The sweet orange varieties (mid and late group) recommended earlier by Punjab Agricultural University are generally available in the market from December-March, which are not popular among the local fruit growers, as its harvesting coincides with harvesting of *Kinnow*. So, to meet the demand of citrus juices in the market, early varieties of sweet oranges were introduced at PAU's Regional Research Station, Abohar and released after

thorough evaluation. Earlier, Mosambi was the only available option in early group of sweet oranges, but it could not gain much commercial importance due to less juice content and granulation problem. Therefore, recently PAU has recommended two early varieties of sweet orange "Vaniglia Sanguigno (Acid less variety) and Early Gold" for commercial cultivation in Punjab, which are free from granulation. The detailed description of these new varieties of sweet oranges are given below.:

Vaniglia Sanguigno: Trees of this variety are semi-vigorous. Fruit size is medium, shape sub-globose to spherical, and texture of rind is smooth to slightly rough. Rind colour changes from green to yellow-orange at maturity. It is an acid less variety. Fruit flesh is pale pink in colour with sweet flavour. It has less number of seeds (4-8) with high juice content (48.1%). Fruit ripens during the second fortnight of October. Its average fruit yield is 47.1 kg/tree. It is recommended for the arid irrigated zone of Punjab.

Distinguishable characteristics: Acid less variety; flesh is pink yellow in colour; and juice is sweet in taste

Early Gold: Trees are semi-vigorous; fruit medium to large in size, sub-globose in shape, slightly rough rind texture; rind colour changes from green yellow to orange at maturity; low seed number (2-6); high juice content (47.23%) with attractive golden yellow colour and have a good blend of sugar and acidity. Ripening takes place during last week of October to mid of November. Its average fruit yield is 45 kg/tree.

Distinguishable characteristics: Rind colour is green yellow to orange; juice golden yellow in colour and seed number 2-6. The planting materials of these recommended varieties of sweet orange will be available during the coming season (July-August) from the fruit nurseries of PAU, located at Regional Research Station, Abohar and Fruit Research Sub-Station, Jalowal-Lesriwal (Jalandhar).

• Anil Kumar Kamra: 9872311677

Integrated management of rice and basmati insect-pests

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During the last year, there was a new problem of dwarf/stunted plants observed that was new viral disease 'Southern Rice Black-streaked Dwarf Virus (SRBSDV),' spread by the insect-vector i.e. whitebacked planthopper (WBPH). In those fields where this disease appeared last year should be observed carefully and prepare the fields well by incorporating previous crop residues before crop season and keep the water channels/bunds free from weeds/grasses.

Rice is an important cash crop ranked second in importance after sugarcane in *kharif* season. In Punjab, rice and *Basmati* occupied an area of 31.45 lakh ha with an annual production of 203.71 lakh tonnes. Among various biotic constraints affecting its production and grain quality, insect-pests play a very important role. The warm humid environment during crop season is very conducive for their development. Due to high pest stress, crop cultivation is mainly dependent on blanket use of synthetic insecticides by the farmers that causes serious health issues as insecticide residue in produce and environment. To check reduction in yield and grain quality, the information about identification, nature of damage and integrated management of the major insect-pests is given below:

STEM BORERS

The crops are attacked by three species of stem borers, *viz.* yellow, white and pink stem borer from July to October. Yellow (Photo 1) and white stem borer females lay eggs near leaf tips in masses, whereas pink stem borer (Photo 2) female lays bead like eggs singly inside the leaf sheath. The larvae bore into stems and feed there. The affected plants in vegetative stage produce yellow and dry central shoots called, 'dead hearts' (Photo 3). These dead hearts can be easily pulled

from the plant, whereas in older plants, damage symptoms are observed as empty earheads which remain white and stand erect called 'white ears'.

Cultural control: Sowing of nursery and transplanting should be restricted as per PAU recommendations to reduce the population build-up of borers especially on the successive *basmati* crop. Avoid cultivation of long duration varieties *viz.* Pusa 44, Peeli Pusa and Dogar Pusa as these require 15-20 per cent more water and demand at least two extra pesticide sprays. Transplant 25-30 day old nursery of PR 126 between June 25 to July 10 and 30-35 day old nursery of other rice varieties after June 20. Similarly, transplant 25-30 day old nursery of *basmati* varieties in first fortnight of July except Pusa Bas. 1509 (25 day old nursery) and CSR 30 in second fortnight of July.

Chemical control: Regular monitoring of crop for stem borers damage is necessary. As and when dead heart damage reaches more than 5 % (economic threshold level (ETL) in rice and more than 2 % (ETL) in *basmati*, apply any one of the recommended insecticide (Table 1). Further spray may be repeated with alternative insecticide, if required.

LEAF FOLDER

The female moth lays translucent, flat and oval eggs on underside of leaf

blades. The young larvae feed on green leaf tissues without folding the leaves, whereas older larvae feed on green tissues by folding leaves. Damaged leaves produce white streaks and become membranous that reduces photosynthetic activities of the crop (Photo 4).

Cultural control: Avoid sowing/transplanting of the crop under tree/building shade, as these places may serve as hot spots for further spread of the pest. Avoid excessive use of nitrogenous fertilizers and frequent irrigations. Do transplanting as per PAU recommendations.

Mechanical control: To dislodge the larvae by passing 20-30 meter long coir/jute rope, forward and backward, both ways while touching the crop canopy. Care should be taken that water must be standing in the crop and this practice should be done before flowering.

Chemical control: Regular monitoring of the crop is necessary; when more than 1/3rd damaged leaves reaches 10% (ETL), apply any of the recommended insecticides (Table 1).

PLANTHOPPERS

These include whitebacked planthopper (Photo 5) and brown planthopper (Photo 5 & 6). The females hoppers lay eggs in leaf sheath tissues. Both nymphs and adults suck sap particularly from the leaf-sheath from July to October. The

damaging symptoms in form of brown dry leaves start appearing from leaf tip downwards and spread to the rest of the plant and such dried plants will appear as dry patches in the field known as ‘hopper burn’ (Photo 7). After drying the plants, the hoppers migrate to the adjoining green plants and within a few days, the area of rusty patches enlarges. These hoppers also excrete honeydew because of which sooty mould develops on the leaves and hinders photosynthetic activities. During last year, a new problem of dwarf/stunted plants was observed due to new virus disease ‘Southern Rice Black-streaked Dwarf Virus (SRBSDV)’ (Photo 8) which was spread by the whitebacked planthopper vector.

Cultural control: Follow alternate wetting and drying of the fields in routine to check hopper population. During incidence of hoppers, the water from the field should be drained out for 3-4 days depending upon the soil type and care should be taken that cracks does not develop in fields.

Chemical control: Do regular monitoring for hopper population. About one month after transplanting, a few plants in the field should be slightly tilted and tapped 2-3 times at the base at weekly interval and count the number of hoppers falling on the water; if a minimum of 5 hoppers per hill (ETL) are seen floating on the water, then the crop should be sprayed with recommended insecticides (Table 1). Further application of any alternate insecticide may be repeated if hopper population again reaches ETL. For better and effective results, direct the spray towards the base of the plants. If damage is noticed at hopper burn stage, treat the affected spots/patches along with 3-4 meter periphery immediately as these spots harbour high population of planthoppers.

GRASSHOPPERS

The nymphs and adults of the

Table 1: Recommended insecticides against insect-pests of rice and basmati

| Insect-pest/ Crop | Insecticide | Brand(s) | Dose (acre) | Application Method |
|---|-----------------------------|---|-------------|-----------------------------|
| Stem borers/ Rice | chlorantraniliprole* | Coragen 18.5 SC | 60 ml | Spray |
| | azadirachtin 5% | Ecotin | 80 ml | |
| | flubendiamide 39.35%* | Fame 480 SC | 20 ml | |
| | flubendiamide 20%* | Takumi 20WG | 50 g | |
| | cartap hydrochloride | Mortar 75 SG | 170 g | |
| Stem borers / Basmati | azadirachtin 5% | Ecotin | 80 ml | Spray |
| | azadirachtin 0.15% | Achook/Neem Kavach | 1 litre | |
| | flubendiamide 39.35%* | Fame 480 SC | 20 ml | |
| | flubendiamide 20%* | Takumi 20WG | 50 g | |
| | chlorantraniliprole* | Coragen 18.5 SC | 60 ml | |
| | cartap hydrochloride | Mortar 75 SG | 170 g | |
| | fipronil | Fipronil 80 WG | 15 g | Broadcast in standing water |
| | chlorantraniliprole* | Ferterra/ Marktera 0.4 GR | 4 kg | |
| | thiocyclam hydrogen oxalate | Vibrant 4 GR | 4 kg | |
| | fipronil | Regent/Mortel/Mifpro-G/ Mahaveer GR/ Shinzen 0.3G | 6 kg | |
| Leaf folder (rice/ basmati) | cartap hydrochloride | Padan/Caldan/Kritap/Sanvex/ Nidan/Marktup/Miftap/ Faltap-G/Katsu 4G | 10 kg | Spray |
| | chlorantraniliprole* | Coragen 18.5 SC | 60 ml | |
| | flubendiamide 39.35%* | Fame 480 SC | 20 ml | |
| | flubendiamide 20%* | Takumi 20WG | 50 g | |
| | azadirachtin 5% | Ecotin | 80 ml | |
| Plant hoppers and grass hoppers (rice/ basmati) | triflumezopyrim | Pexalon 10 SC | 94 ml | Spray |
| | dinotefuran | Osheen/ Token/ Dominant 20 SG | 80 g | |
| | pymetrozine | Chess 50 WG | 120 g | |
| | benzpyrimoxan | Orchestra 10 SC | 400 ml | |
| | flupyrimin | Imagine 10 SC | 300 ml | |
| | Quinalphos | Ekalux/Quinguard/ Quinalmass 25 EC | 800 ml | |
| | azadirachtin 5% | Ecotin | 80 ml | |
| PAU Homemade Neem Extract | PAU Homemade Neem Extract | 4 litre | | |
| Hispa (Rice/ basmati) | quinalphos | Ekalux | 800 ml | |

grasshoppers eat the leaves, especially in nursery. Sometimes may be complete defoliate of the plants and growth is affected. The surrounding crops area should be free from grassy weeds. Insecticides recommended against plant hoppers are also effective against grasshoppers.

RICE HISPA

The shiny bluish-black adult beetles are also called as *kandian waali bhundii* due to presence of numerous short spines over the body. The female beetle lays eggs within the epidermal layers on the underside of apical portion of the leaves. The adult beetles are external feeders,

while grubs feed by tunneling into the leaves and cause damage by producing bold, white streaks on the leaves that reduce photosynthetic activities.


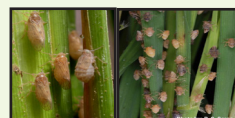





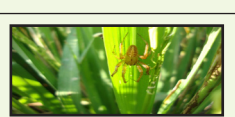

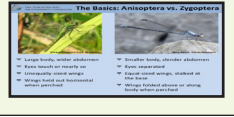
Control: The pest is more prone in waterlogged and low lying area, so drain out excessive water from infested fields. If attack starts in the nursery, clip-off and destroy the leaf tips before transplanting. In transplanted crop, spray the crop with any of the recommended insecticides (Table 1).

PREVENTIVE MEASURES FOR INSECT-PESTS MANAGEMENT

During the last year, there was a new problem of dwarf/stunted plants observed that was new viral disease ‘Southern Rice Black-streaked Dwarf Virus (SRBSDV)’ (Photo 8), spread by the insect-vector i.e. whitebacked planthopper (WBPH). In those fields where this disease appeared last year should be observed carefully and prepare the fields well by incorporating previous crop residues before crop season and keep the water channels/bunds free from weeds/grasses.

- In early crop stage, need to monitor WBPH population by installing light traps near crop area. If WBPH population is observed, then spray recommended insecticides (Table 1).
- Avoid early sowing and transplanting, it was observed last year that dwarf/stunted plants were comparatively more in early-transplanted crop as compared to late.
- If the stunted rice plants are seen in nursery/main field, uproot these and bury deep in the soil.
- Laser leveling is necessary to avoid excessive irrigations.
- Apply only recommended dosage of nitrogenous fertilizers on soil test basis or by use of PAU-Leaf Colour Chart (available at PAU seed shop

Table: Insect-pests, their damaging symptoms and natural enemies

| Photo No. | Insect-pest/damaging symptom | Identification | Photo No. | Insect-pest/damaging symptom | Identification |
|-----------|---|--|-----------|---|---|
| 1 | Yellow stem borer adult |  | 6 | Brown planthopper adults and nymphs |  |
| 2 | Pink stem borer adult |  | 7 | Hopper burn by plant hoppers |  |
| 3 | Dead heart |  | 8 | Dwarf/stunted plants due to new virus disease |  |
| 4 | Leaf folder incidence |  | 9 | Spider |  |
| 5 | Whitebacked planthopper adults and nymphs |  | 10 | Dragonfly |  |

main campus, Regional Stations/ KVKs/FASCs). In *basmati* crop, do not apply nitrogenous fertilizer after green manuring.

- In rice ecosystem, there are many species of natural enemies like spiders (Photo 9), coccinellids; dragonflies (Photo 10), damselfly and these are very effective against rice insect-pests. Therefore, care should be taken to do need-based insecticidal application only.

CAUTION

- Do not perform early season blanket application of insecticides, particularly synthetic pyrethroids as they result in an increase in the population of insect-pests, especially plant hoppers.
- Apply only the recommended dose of insecticides by using 100 litres of water per acre with Knapsack sprayer having fixed type hollow cone nozzle. In *basmati* crop, granular insecticides

should be applied in standing water after wearing gloves.

* Chemicals belong to green chemistry category. Prefer Ecotin or PAU Homemade *Neem* Extract at pest initiation stage.

Method of preparation of PAU Homemade *Neem* Extract: Boil 4.0 kg terminal parts (including leaves, green branches and fruits) of *neem* trees in 10 liters of water for 30 minutes. Then filter this material through muslin cloth and use the filtrate for spraying at the recommended dose.

Note: Fame 480 SC or Takumi 20 WG or Coragen 18.5 SC or Mortar 75 SG or chlorpyrifos 20 EC or Fipronil 80 WG or Ferterra 0.4 GR or Vibrant 4 GR or Padan/ Kritap/Caldan/Sanvex/Nidan/Marktup/ Miftap/Faltap-G/Katsu 4G or Regent/Mortel/ Mifpro-G/Mahaveer GR/Shinzen 0.3G or Dursban 10G also control leaf folder on *basmati*.

- **Preetinder Singh Sarao: 98720-06248**

Integrated disease management of rice and basmati

PARMINDER KAUR, MANDEEP HUNJAN AND YESMIN KAUR

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Rice (*Oryza sativa* L.) is the premier and most important cereal crop. The diseases which are the major constraint in the profitable cultivation of rice and *basmati* are foot rot, sheath blight, brown leaf spot, false smut, blast, etc. The nature of damage and integrated management strategies of these diseases is given below.

Foot rot (*Fusarium moniliforme*) - This disease is both seed and soil borne. The disease attacks in nursery as well as soon after transplantation. The seedlings are taller, thin with yellowish green leaves. The seedlings start drying from the bottom and die at early tillering stage. Under favourable weather conditions, white pinkish growth of fungus is visible at base of the plants and adventitious roots appear on the lower nodes. Plants die in about 2-6 weeks after infection.

Sheath blight (*Rhizoctonia solani*) - The disease is soil borne in nature. The fungus attacks the crop from tillering to heading stage. The initial symptoms are observed on the leaf sheath near the water level and also on the outer side of the field. Firstly, small, ellipsoidal or ovoid, greenish-grey lesions develop on the leaf sheath. As the lesion enlarges, the centre becomes grayish white with an irregular purple margin. The lesions extend rapidly coalescing with each other and cover

entire tillers from the base to the flag leaf.

Brown leaf spot (*Drechslera oryzae*)- The disease is seed borne in nature. The symptoms appear as minute, oval, eye-shaped brown spots with a prominent dark-brown dot in the centre and a light brown margin.

False smut (*Ustilaginoidea virens*) - The symptoms of the disease are visible after flowering in which the fungus infects the young ovary of individual grain and transforms them into large, velvety green balls (smut balls). Only few grains in a panicle are infected.

Blast (*Pyricularia grisea*) - The disease attack is more on the *Basmati* varieties. The initial symptoms of this disease develop as spindle shaped spots with white to greyish centre and brown margins on the leaves at maximum tillering stage. Symptoms in the form of black lesions are also observed on the neck of the panicle which results in drooping of the panicle and breaks at the weak point, thus causing heavy loss.

Management of diseases

The yield losses could be prevented by timely adopting effective control measures which are as given below:

1. Always grow recommended varieties of rice and basmati, which are resistant to most of the pathotypes of bacterial blight pathogen.
2. Apply seed treatment for the diseases

which are seed borne in nature.

3. Treat the seed with 3 g Sprint 75 WS (carbendazim + mancozeb) by making slurry in 10 ml water for one kg seed before sowing for control of seed borne diseases.
4. Those farmers who are adopting organic farming can also go for seed and seedling dip treatment with *Trichoderma harzianum* for the management of foot rot disease in *Basmati*.
5. Rouge out foot rot infected tall plants from the nursery as well as from the field carefully along with the roots.
6. Avoid sowing *basmati* earlier than the recommended time and do not grow *basmati* in previously infected fields.
7. Avoid the use of excessive nitrogenous fertilizers as high application of nitrogen aggravates this disease.
8. Remove or burn the infected stubbles and rice straw to reduce the amount of inoculum for the succeeding cropping season.
9. 12. Spray the crop twice with any one of the following fungicides as soon as the disease appears,
 - 150 ml Iglare/Pulsor 24 SC (thiophanate-methyl) or 26.8 g Epic 75 WG (hexaconazole) or 400 ml Galileo Way 18.76 SC (picoxystrobin + propiconazole) or 200 ml Amistar Top 325 SC or Tilt/Bumper/Pikapika 25 EC (propiconazole)



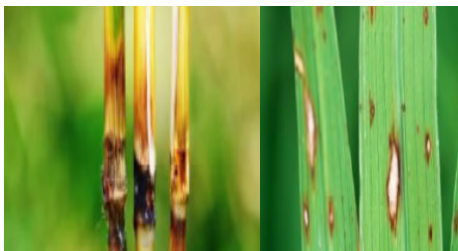
Foot rot



Sheath blight



Brown leaf spot

**Blast**

or Folicur/Orius (tebuconazole) 25 EC or 80 g Nativo 75 WG (trifloxystrobin+tebuconazole) or 320 ml Lusture 37.5 SE (flusilazole + carbendazim) or 200 ml Monceren 250 SC (pencycuron) in 200 litres of water per acre give effective results against this disease. Give second spray after 15 days.

10. Brown leaf spot disease was more prevalent in Direct seeded rice

**False smut**

during last year. It occurs in poor soils. So, application of adequate and balanced nutrition to the crop should be recommended.

11. Brown leaf spot can also be managed by spraying the crop with 80 g Nativo 75 WG (trifloxystrobin + tebuconazole) in 200 litres of water per acre. Spray the crop first at boot stage and second after 15 days of interval.
12. False smut disease spreads during

wet weather conditions. So, apply thin irrigation after percolation of water into the soil.

13. To control false smut disease, spray the crop with 400 ml Galileo Way 18.76 SC (picoxystrobin + propiconazole) or 500 g Kocide 46 DF (copper hydroxide) in 200 litres of water per acre at boot stage in disease prone areas.
14. For controlling blast, spray the crop with 200 ml Amistar Top 325 SC (azoxystrobin + tebuconazole) or 500 g Indofil Z-78, 75 WP (zineb) per acre in 200 litres of water at boot and ear emergence stages.
15. Always use cone type of nozzle for effective management of diseases.

• **Parminder Kaur 98770-85223**

Importance of potable water in rainy season

PRIYA KATYAL, KESHANI AND GS KOCHER

Department of Microbiology

Water that is free from pathogenic microbes and suitable for drinking or cooking purpose is known as potable water. While cases of water borne diseases may occur throughout the year, a seasonal increase is noted in the summer, monsoon and post-monsoon period. During rainy season, the moisture content in the air increases which provide a more suitable condition for the microbes to grow. So communicable diseases spread more easily and rapidly in rainy season. Water Quality Testing is an important measure to identify contaminants and to prevent water borne diseases. It ensures that water is safe or not for drinking purposes as per national and international standards.

At PAU, the Department of Microbiology is regularly involved in microbial testing of drinking water. Water sample can be either brought to our lab for testing @ Rs 100 per sample and a report can be collected after 48 hours.

Method of water collection for sending water sample

- The time between sample collection and

analysis should, in general, not exceed 6 hours, and 24 hours is considered the absolute maximum.

- Wipe off the tap to remove dirt from outside and sterilize the tap using alcohol and burner.
- Allow the water to flow at medium rate to 1-2 minutes.
- Take the sample by holding sterilized sampling bottles from base under the water jet.
- Stopper the cap and mention detail including source, time and date of sampling, depth of source and distance from latrine/Brooke if present.
- The samples should be analyzed within 24 hrs of collection by transporting in refrigerated conditions.

Method of use of water kit

- Open the aluminium foil and keep the rubber stopper intact.
- Open the kit near the water source and dispense the water samples to be tested or screened for bacteriological probability, aseptically in kit bottles up to the calibrated mark.



- Record the observation from 12 hrs to 48 hrs for change in colour, turbidity, sedimentation, pellicle formation and popping of lid.
- Change in colour from purple to yellow indicates acid production and popping of stopper indicates gas production by coliform bacteria.
- Add few drops of dettol and discard.
- In case water sample is found to be contaminated i.e. showing change in colour and popping up of stopper within 48 hrs, consult the experts in Department of Microbiology.

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Integrated management of diseases of *kharif* maize

HARLEEN KAUR AND AMARJIT SINGH

Department of Plant Breeding and Genetics

Maize is the third important cereal crop after wheat and rice in Punjab with an area of about 105.2 thousand hectares, and a production and productivity of 413.4 thousand tonnes and 39.30 q/ha respectively during the year 2021-22. Being a short-duration crop, it conveniently fits into a wide range of crop rotations and thus plays an important role in crop diversification programme in the State. Punjab Agricultural University has recommended a number of maize varieties including some tested private sector hybrids according to their use and suitability to different climatic conditions of Punjab State. The potential of our recommended cultivars is much higher than the state average. This yield gap is mainly due to the losses caused by biotic factors. If the crop is well managed, there is no doubt that it can give very good yields and good profits and that is only possible if the farmers are able to diagnose and manage the symptoms of various diseases well in time. Major diseases attacking maize crop are seed rot and seedling blight, leaf and sheath blights, and pre and post flowering stalk rots. To prevent losses from these diseases, it is necessary to follow a comprehensive integrated disease management program.

Seed rot and seedling blight

This disease is caused by number of soil borne and seed borne pathogens. The

symptoms may appear at pre-emergence or post emergence stage of the plant. Pre emergence seed rot is often confused with poor quality of hybrid seed as it causes poor germination and patchy growth of the seedlings. Post emergence symptoms include damping off of seedlings, rotting of collar region and wilting of the plant. Finally the plant topples down and the seedlings collapse. This results into a thin uneven stand in the field. This disease occurs mainly in areas with moist and cold soils, and is a great handicap in maintaining proper stand. Loss of even a single plant results in quantitative yield loss at farmers' level. Avoid planting of maize in poorly drained soils. Use healthy, bold and preferably fresh seed for sowing. If old seed is to be used, it must be stored under low temperature and humidity conditions.

Banded Leaf and Sheath Blight

This disease starts appearing at 35-40 days after sowing. Water soaked, straw colored necrotic lesions alternating with dark brown bands develop on basal leaf sheaths. Lesions enlarge and coalesce with each other. Later, sclerotia develop on diseased sheaths, husk and cobs. In severe cases, developing ears are completely damaged and dry up prematurely with cracking of husk. The fungal pathogen is soil borne and also survives on large number of wild and cultivated plants. To manage this disease, spray Amistar Top 325 SC (azoxystrobin + difenoconazole) @ 100 ml in 200 litres of water/acre at disease appearance. If needed, repeat the spray at 15 days interval.

Maydis Leaf Blight

This disease starts appearing from the first week of July throughout the State. Symptoms appear as spindle shaped water soaked chlorotic lesions on the leaves which later coalesce to give blightened appearance to the leaf. In extreme cases, the symptoms also appear on leaf sheaths, cob husks and ears. Though the hybrids recommended for cultivation in State possess tolerance to this disease, but it has due significance in inbred lines, breeders seeds and hybrid seed production plots. Late sowing and susceptible cultivars aggravate this disease. For managing this disease, spray Indofil M-45 @ 200 g in 100 litres of water after about fortnight of sowing. Give two more sprays at 10 days interval.

Bacterial Stalk Rot

This bacterial disease occurs at pre-flowering stage of the crop and becomes severe in heavy soils under high temperature and humidity conditions. Frequent rains and water logged conditions at farmer's field in August and September aggravate this problem. The basal internodes develop soft rots and emit characteristic fermenting odour. The rind loses its natural green colour and becomes pale straw colored as if boiled in water. Ear shoots and cobs occasionally get infected directly, but these droop down and hang limply on the infected plant. Ultimately, the stalk breaks and the plant collapses. To minimise the yield loss, farmers are advised to keep their fields well drained and must not allow water to stagnate. Dense planting should be avoided. Ridge sowing should be preferred than flat sowing in disease prone areas of Punjab. Use of



Bacterial Stalk Rot

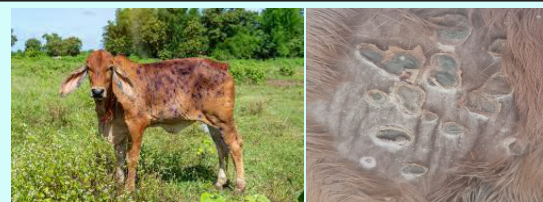
improved varieties along with destruction of diseased debris in affected fields helps to reduce the incidence of this disease.

Post Flowering Stalk Rots

Post flowering stalk rot is a complex problem caused by number of fungi, out of which, charcoal rot and Fusarium stalk rot cause economic damage to maize crop under Punjab conditions. The symptoms of the disease become more conspicuous when plants show premature drying. The pathogen commonly attacks the roots, collar region and lower internodes. The affected internodes become pale, pith become soft and spongy, resulting in deterioration of the vascular system. The disease induces rapid wilting and premature drying at or after flowering. The infected stalks show reddish browning of parenchymatous tissues. The most economical and efficient method of disease control is the cultivation of resistant hybrids PMH 14 and PMH 13. Stay green character of hybrids imparts resistance to stalk rot pathogens. Water stress at flowering predisposes the plants to infection. Crop sanitation, adequate balanced fertilizers and recommended plant density is required to reduce the incidence of this disease. Healthy and vigorous plants are more tolerant to post flowering stalk rot disease and thus, able to produce comparatively higher yields.

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Lumpy Skin Disease of cattle and buffalo



MUNISH KUMAR AND ROHIT KUMAR

Krishi Vigyan Kendra, Ferozepur

What is LSD?

Lumpy skin disease commonly called LSD is a viral infection of cattle and buffalo which is characterised by fever, lacrimation, hypersalivation, and distinctive skin lesions in the form of nodules. Its incidence is highest in hot and humid summer season. The disease was originally diagnosed in Africa but now it has spread to other parts of the world such as Middle East, Asia, and Eastern Europe. Last year, disease appeared in India particularly in Punjab on a larger scale and had a devastating effect on bovine population especially in cattle. Apart from terrifying look of the affected animal, economic losses occur due to decrease in milk yield and in worst case, death of animal. However, economic losses vary with the severity of the disease.

Cause and Transmission

Lumpy skin disease is caused by the lumpy skin disease virus (LSDV), a member of the family Poxviridae and is related to the Goat pox virus. This virus is host specific and causes infection in cattle and buffalo. Infection in buffalo is less than cattle and it does not infect humans. Virus commonly spreads through stable fly, mosquito and some tick species. Moreover it also spreads to faraway places through transfer of affected animals between different farms. Infected animals also shed virus through saliva, nasal and ocular discharges which may contaminate feed and water and further spread occurs.

Clinical signs

Common clinical signs which appear in infected animal are:

Fever which may be high grade. Immediate decrease in milk yield. Discharge from eyes

and nose. Highly characteristic nodular skin lesions of 1-5 cm size. The number of nodules on skin varies in mild and severely infected animals. Skin nodules may persist for several months. Lameness may appear in animals having lesions in legs which are complicated by secondary bacterial infections. Pneumonia caused by the virus itself or secondary bacterial infections is one of the major cause of death of animal. Subclinical infections are common. Severe cases of LSD are highly characteristic and easy to recognize.

Prevention and control

- Farmer's awareness about the disease is of utmost importance to prevent the spread of disease.
- Vaccination of healthy animals is the most favourable method of control to prevent spread of infection.
- Provide balanced diet to the animals for better immunity to fight against the disease.
- Prevent and control ticks and flies in the dairy herd.
- If any animal is affected with the disease, immediately separate affected animal from healthy animals.
- As signs appear in the animal, immediate care of wound is must using common antiseptic solutions.
- Disinfection of dairy premises.
- "Prevention is better than cure" rule should be followed, so movement of people from infected animals to healthy animals must be restricted.
- Administer antibiotics to control secondary infection.
- Only medication in consultancy with the expert veterinarian.

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Pink bollworm management in cotton by mating disruption

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Diverse pest management strategies, including chemical, biological, mechanical, and cultural ones, are employed to protect crops against insect-pests. Due to their delayed rate of action, biological and cultural treatments are not as effective as chemical methods; hence chemical control is still the method of choice for farmers. Chemical overuse has harmful consequences on the environment and non-targets that have been well-documented. Eco-friendly management methods are urgently needed, and one cutting-edge strategy being investigated for widespread pest management in a variety of crops is mating disruption.

Mating disruption, a pest management approach, is intended to eliminate some insect-pests by delivering artificial stimuli to confuse the male individuals and disturb mate localisation and/or courtship. This prevents mating and blocks the reproductive cycle (Fig 1). The sex pheromone for a species is released by females as a pheromone plume, an aerial trail of a particular chemical concoction.

In this method a synthetic pheromone, a volatile organic chemical, is designed that mimics the species-specific sex pheromone produced by the female insect and released into the air. By concealing the action of natural pheromone, this organic compound perplexes the male insect, making it challenging for them to locate the females for mating. As a result, it helps to reduce the number of insects in the next generation. Among the successful examples, mating disruption has been able to reduce codling moths in apple orchards and oriental fruit moths in peach orchards, thus leading

to considerable decrease in insecticide residues in European nations and California, respectively. The artificially produced pheromone can be applied in the field in the form of various formulations such as paste, slow-releasing dispensers, and spray. Because it is simpler to apply and more environmentally friendly than chemical pest control, this approach of pest management has been

shown to be more advantageous. Some other advantages are listed as below:

- Pheromones are less likely than chemicals to cause the development of resistance.
- Hinders reproduction and slows down the spread/ multiplication of insects.
- No adverse effect on non-targets.
- Slow release for extended effectiveness.
- Rain fastness and sustained stability in hot conditions.
- Easy to use and does not require any type of equipment such as a spraying pump, thus saving cost and time.
- Minimal labor-intensive.
- Useful for pest management in organic agriculture.

In the last few years, in South India, this method has been proven to be very useful in controlling pink bollworms in cotton crop fields. It has been approved by the Punjab Agricultural University for the management of pink bollworm in cotton.

For the management of pink bollworm, three applications of SPLAT based (Specialized Pheromone Lure

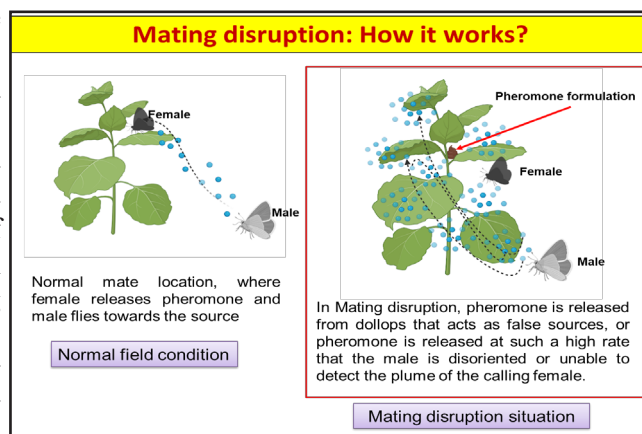


Figure 1: Mating disruption: How it works?

Application Technology) CREMIT PBW (Gossyplure 4%; 7,11 Hexadecadienyl acetate) should be applied @ 125 g per application per acre in the form of blob (peanut size) starting from the appearance of squares (45-55 days after sowing) at 400 uniformly distributed spots.

Method of application: SPLAT should be applied at the nodal junction of the 5th or 6th main stem leaf from the top. To obtain the optimum efficacy, timely and area-wide application of SPLAT is indispensable. Appropriate time: Use it only when the sky is clear. The application must be repeated if it rains within four to five hours.

Duration of use: Apply the first dose 45-55 days after sowing followed by the next two applications at 30 days interval.

Precautions: To avoid inhalation and skin contact, farmers should wear gloves, masks, and protective clothing while handling or applying, and hands should be thoroughly washed with soap and water after application. Remove contaminated clothes and wash them before reuse.

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Integrated approach for management of stored grain insect-pests

MANPREET KAUR SAINI AND DK SHARMA

Department of Processing and Food Engineering

Stored grain insect-pests are a serious concern for the farmers who store their produce for seed, consumption or marketing purpose. The weather conditions from May to October were found to be the most suitable for the fast multiplication of insects. There are nearly 20 species of insect-pests which have been reported in Punjab and are causing heavy storage losses. These insect-pests are divided into two categories: Primary insects that feed on sound/healthy grains and secondary insects that feed on milled products. They cause significant losses to stored products in term of grain damage and weight loss by making holes; eating endosperm; making powder, webs in cereals, pulses, oilseeds, milled products and finally affect the nutritive value of the products. The important insect-pests of stored grains found in Punjab include:

Primary insect-pests

- **Lesser grain borer:** Adult and grub attack wheat, rice and maize. Grub feeds on waste flour and adult feeds on healthy grains.
- **Khapra beetle:** Grub attacks wheat,

rice, maize, jowar, pulses and oilseeds. It feeds externally and damages the whole grain.

- **Rice weevil:** Adult and grub attack wheat, rice and maize. Adult makes holes in the grains and grub feeds on starchy content of the grains.
- **Pulse beetle:** Grub attacks all whole pulses and bores inside the grain, eats out its contents and pupates inside it.
- **Angoumois grain moth:** Larvae attack rice, maize, jowar, barley and wheat. It bores into the grain and feeds on its contents. As it grows, it extends the hole, which partly gets filled with pellets of excreta.

Secondary insect-pests

- **Rust red flour beetle:** Adult and grub damage the broken grains, milled products, flour and the germ portion of the healthy seeds. Heavy infestation in flour causes stinking odour, which adversely affects the quality.
- **Rice moth:** The larvae attack rice, jowar, other millets, pulses, processed

products, oilseeds, nuts and milled spices. Young larvae feed broken grains and then web these food grains with faecal matter.

- **Saw toothed beetle:** Adults and grubs attack wheat, barley, rice, sorghum, bajra, milled products, dried fruits and animal feed. They can only feed on broken grains and grub preferentially feeds on the germ portion of grains.

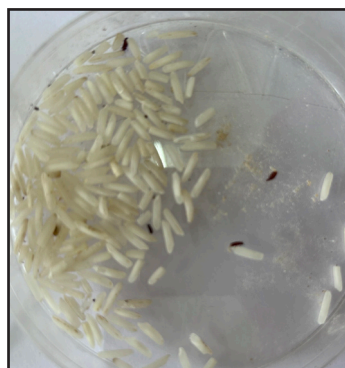
Management strategies to protect stored grains from insect-pests: One of the most effective methods still used worldwide as the grain protection measure against storage insect-pests is the fumigation. The fumigation method has been used all over where the grains are stored for domestic, commercial and seed purposes round the year. But it is always advised to use integrated pest management strategies which include:

Preventive measures

- Plugging of all cracks, crevices and holes in the godowns with mud or cement.
- Thoroughly cleaning and sweeping



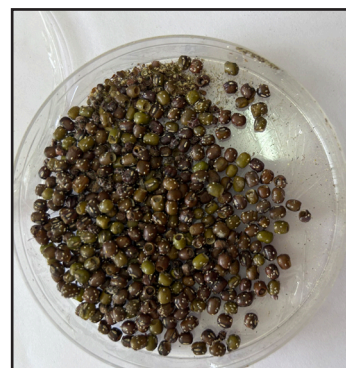
Lesser grain borer in wheat



Red rust flour beetle in rice



Pulse beetle in Kabuli channa



Pulse beetle in moong grains

Damaging symptoms of stored grain insect-pests

- of godowns and sweepings should be destroyed by burning or burying deep in the soil.
- Clean, sort and dry the grains before storage.
- New grains should be stored in clean godowns or receptacles.
- Do not mix new grains with old stock as later on it may get infested with insects.
- The stores should be damp proof and there should be no leakage or seepage.
- Metal bins/drums should also be cleaned properly and kept in sun for 2-3 days before filling the grains.
- Grains meant for storage should be dried properly and moisture content not be more than 9 %.

- Bins should be filled to their full capacity and lid should be tightened properly.
- Use new gunny bags for storing grains meant for consumption.
- Empty godowns should be disinfested with 100 ml of Cythion 50 EC (Malathion premium grade) in 10 litres of water on the floor, walls and ceiling. The spray should be done on the floor, walls and ceiling or fumigate the godowns with 25 tablets of aluminium phosphide per 100 cubic metre of empty space before storing the grains. Exposure period should be of 7 days. In case, there is infestation of *khapra beetle*, then use double dose of aluminium phosphide.
- Cover the stored pulses in bulk with 7

cm layer of sand, sawdust or dung ash to protect it from pulse beetle (Dhora).

Curative measures

Fumigation of stores can be done by using Phostoxin or Delicia or Celphos (aluminium phosphide) one tablet of 3 g/tonne of grains or 25 tablets/100 m³ space. Exposure period of these fumigants is for 7 days.

Whenever we use chemical insecticides, there is a need to follow the precautions as aluminium phosphide is highly poisonous gas, if used inappropriately leads to death. Always air tight the room or cover the produce with *tarpsaulins* properly after using aluminium phosphide. Avoid its use in the drum or godowns near to living areas.

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Tips for efficient use of PAU fruit fly traps

RAJWINDER KAUR SANDHU, SANDEEP SINGH AND RK SHARMA

Department of Fruit Science

Fruit flies attack many fruits such as *Kinnow*, guava, mango, pear, peach, plum and *ber*. In Punjab, the population of fruit flies starts building-up in February-March on *ber* and continues upto November-December



on *Kinnow* and other citrus fruits. The PAU has recommended PAU Fruit Fly Trap for the management of fruit flies in fruit crops in 2013 and from 2014, PAU Fruit Fly Traps have been made available to fruit growers by Fruit Entomology Laboratory, Department of Fruit Science, PAU.

Timing and guide to install the PAU Fruit Fly Traps

| Fruit Crop | Right Time |
|------------|------------------------|
| <i>Ber</i> | First week of February |
| Plum | Second week of April |
| Peach | First week of May |
| Mango | Third week of May |

| | |
|---------------|-----------------------|
| Pear | First week of June |
| Guava | First week of July |
| <i>Kinnow</i> | Second week of August |

Fix PAU fruit fly traps @16 traps/acre and recharge the traps with plywood septa, if required. Traps should be fastened to the trees using metallic wires/tags, at a height of 1-1.5 metre, depending on the height of fruit tree.

Important tips to use PAU Fruit Fly Traps

- Packing of the traps should be opened in the orchard itself just before fixing the traps on the trees.
- Traps should be fixed in the orchards at recommended time and in recommended number only.
- Remove the dead fruit flies from the traps when they are 75 per cent filled.
- Fruit growers are requested to fix traps at fruiting stage and recommended time only.
- These traps are effective for management of fruit flies infesting fruit crops only and not in vegetable crops.

- The traps should be kept in these fruit crops till the fruit harvesting is over.

Availability of PAU fruit fly traps

- The PAU fruit fly traps are available for sale at room number 19, Department of Fruit Science, PAU, Ludhiana. Cost of 1 trap is Rs 118 and cost of 1 plywood septa is Rs 80. Contact person: Dr Sandeep Singh, Principal Entomologist (Fruits).
- Booking of traps at PAU, Ludhiana can be made on mobile no. 99886-86072, 98724-22248, 98725-80391; and telephone no. 0161-2401960 Ext. 303 (Fruit Science) on any working day from 9.30 am to 4.30 pm or by e-mail: sandeep_pau.1974@pau.edu.
- Orders for purchase of traps can also be made at *Krishi Vigyan Kendras*/Farm Advisory Service Centre/Regional Research Stations/Fruit Research Stations of PAU, Ludhiana and Deputy Director Horticulture and Horticulture Development Officers of the State Department of Horticulture, Punjab.
- *Rajwinder Kaur Sandhu: 9779861180*

Integrated pest management in brinjal, okra and cucurbits

RAVINDER SINGH CHANDI, KS SURI AND SANJEEV KUMAR KATARIA

Department of Entomology

Several abiotic and biotic factors affect successful vegetables cultivation from sowing to harvesting. A number of insect-pests attack these crops and pose a major threat to cultivation of these crops. A well planned integrated management approach against insect-pests could lead to higher yields and increased profits. The identification of insect-pests, their nature of damage and management techniques on brinjal, okra and cucurbit crops are described below:

BRINJAL

Brinjal shoot and fruit borer: It is the most destructive pest of brinjal. Female lays 80-120 creamy white eggs, singly or in batches of 2-4 on the underside of leaves, on green stems, flower buds or the calyx of fruits.

Nature of damage: The larvae bore into the growing shoots or petioles of large leaves and feed on internal tissues. As a result of damage, affected shoots wither and plants exhibit the symptoms of drooping. Large holes seen on the fruits are the exit holes. The remains of brinjal plant/stalks from previous crop serves as source of carry over to next crop.

Management strategies

- Do not ratoon the brinjal crop.
- Removal and destruction of affected shoot and fruits along with larvae.
- Spray 80 ml Coragen 18.5 SC (chlorantraniliprole) or 80 g Proclaim 5SG (emamectin benzoate) or 100 ml Sumicidin 20 EC (fenvalerate) or 200 ml Ripcord 10E (cypermethrin) or



160 ml Decis 2.8 EC (deltamethrin) in 100-125 litres of water per acre.

- A waiting period of 3 days for Proclaim and 7 days for Coragen should be observed after spray.

Hadda beetles: It causes severe damage during May to September. Beetles bear 28 spots surrounded by yellowish rings on their elytron. Grubs are yellowish in colour. The pupae are darker and found fixed on the leaves stems and most commonly at the base of the plants.

Nature of damage: Both grubs and adults feed by scraping chlorophyll from leaves, leaving the veins and veinlets, and causing characteristic skeletonized patches on the leaves. In severe cases, even calyx of the fruit may also be infested.

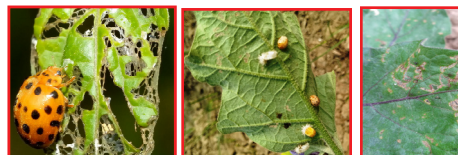
Management strategies

- Collect and destroy egg masses and skeletonised leaves with adults and grubs.
- Hand picking of grubs and collection of beetles by hand nets in the early stages of attack is recommended for small holdings.

Whitefly: Damage is caused by nymphs and adults in two ways: the vitality of the plant is lowered through the loss of cell sap and secondly photosynthesis is interfered due to the growth of a sooty mould on honeydew excreted by the insect. Growth of the plants is affected adversely and yield is also lowered considerably.

Management strategies

- In brinjal, economic threshold level



for whitefly is 9 adults/leaf. For its control, spray 1200 ml *PAU neem extract or 1500 ml maize/sorghum/bajra juice in 100-125 litres water per acre and repeat after 7 days of first spray, if required.

- Under sever infestation, spray 200 g Pegasus 50WP (diafenthiuron) in 100-125 litres water/acre.

* **Method of preparation of PAU neem extract:** Boil 4.0 kg terminal parts of the shoots of neem trees including leaves, green branches and fruits in 10 litres of water for 30 minutes. Then filter this material through muslin cloth and use the filtrate for spraying at the recommended dose.

Red spider mite: This mite attacks during April-June and is very serious when the conditions are hot and dry. It feeds on several host plants including vegetables like brinjal, cowpea, cucurbits, beans, etc. Adults are ovate, reddish brown with four pairs of legs. Life cycle is completed in about 20 days.

Nature of damage: Initially yellowish-white specks appear on leaves followed by scorching and leaf fall. Colonies of mites are found feeding on lower surface of leaves under fine silken webs, resulting in yellow spots on dorsal surface of leaves. Affected leaves gradually curl, get wrinkled and crumpled, ultimately causing webbing, necrosis and defoliation.

Management strategies

- Avoid ratoon crop of brinjal.
- Spray 300 ml Omite 57 EC in 150 litres of water per acre.

OKRA

Jassid: It is a major sucking pest and

in addition to okra, it is also found on potato, brinjal, cotton, etc. Females lay yellowish eggs on the underside of the leaves, embedding them into the leaf veins. Nymphs are wedge-shaped and very active.

Nature of damage: Damage to the crop is caused by both nymphs and adults by sucking cell sap from the underside of the leaves during May to September. Damaged leaves show yellowing and curling along the margins, turn pale and then rust red.

Management strategies

- Cultivation of tolerant/less susceptible varieties like Punjab 8.
- In okra, economic threshold level for jassid is 4 nymphs/leaf. For its management, spray 2000 ml PAU neem extract or 80 ml Ecotin 5% (neem based insecticide) or with 40 ml Confidor 17.8 SL (imidacloprid) or 40 g Actara 25 WG (thiamethoxam) or 560 ml Malathion 50 EC in 100-125 litres of water per acre.
- A waiting period of one day for Confidor and Actara should be observed after the spray.

2.Spotted bollworm: This pest causes damage during May to September. It has two species *Earius insulana* and *E. vittella*.

Nature of damage: The larvae bore into the growing shoots, flower buds, flowers and fruits either killing the plants or causing heavy shedding of fruiting bodies. Shoots infested with borer droop downwards and dry up. Fruits become distorted, have holes and are rendered unfit for consumption.

Management strategies

- Cultivation of tolerant/less susceptible varieties like Punjab 8.
- Uproot ratooned cotton and



hollyhock which are host plants for bollworms.

- Remove regularly the attacked fruits and bury deep in the soil.
- In okra, economic threshold level for spotted bollworm is 1% infested fruits.
- For its management, spray 50 ml Coragen 18.5 SC (chlorantraniliprole) or 200 ml Sumipleo 10EC (pyridalyl) or 70 g Proclaim 05SG (emamectin benzoate) or 100 ml of Sumicidin 20EC (fenvalerate) or 80 ml of Cymbush 25EC (cypermethrin) per acre in 100-125 litres of water.

Whitefly: It causes maximum damage during July-September. Its adults and nymphs suck sap from leaves and excrete honey dew on leaves which become sticky. Affected leaves turn black due to development of sooty mould.

Control measures: For its management, spray 80 ml Ecotin 5% (neem based insecticide) or 2000 ml *PAU neem extract.

Precautions

- Pick regularly all ripe fruits before spraying.
- Regular monitoring of the crop should be done to check for whitefly infestation.
- Regular surveillance on alternate host crops should be carried out for timely management.
- Eradication of weeds growing on field bunds, waste lands, roadsides and irrigation channels/canals to avoid further spread of whitefly to okra fields.
- Avoid usage of synthetic pyrethroids to minimize the whitefly resurgence.

Red spider mites: These mites attack the leaves, suck the cell sap and ultimately cause webbing, necrosis and defoliation.

Control measures: Spray the crop



with 150 ml Oberon 22.9 EC per acre using 120-150 litres water.

CUCURBITS

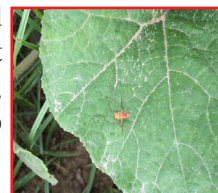
Whitefly: The nymphs of this insect are pale-yellow and adults are 1.0-1.5 mm long with yellowish bodies, white wings and covered with a white waxy powder.

Damage: Nymphs and adults cause damage by sucking the cell sap and lower the vitality of the plant.

Management: For its control, spray PAU neem extract @ 1200 ml/acre in 100-125 litres and repeat after 7 days of first spray.

Red pumpkin beetle: This insect attacks cucumber, squash gourd, pumpkin, sponge gourd, etc. but is more serious on muskmelon. The grubs of these beetles are creamy white in colour.

Damage: Beetles attack their hosts in February and remain active till October with peak activity period during March-April. Their damage begins at seedling stage i.e. 2-3 leaf stage and can cause serious losses to the crop at this stage. The adults attack by making irregular holes in the leaves and sometimes can result in complete defoliation. The grubs feed on underground portions of the plant like stem and roots, leading to drying up of the vines.



Management: After germination, dust dung ash on the plants 3-4 times at weekly interval during initial days of crop growth.



Fruit flies: These are most destructive insect-pests of muskmelon and other cucurbits. Immature stages of fruit fly are known as maggot.



Damage: The infestation of this

insect starts in March with peak activity during June-July. The maggots attack developing fruits and make holes in the fruits and feed inside. As a result, fruits remain smaller in size and get separated from the vines. After first shower of monsoon, the infestation increases.

Management: i) Use PAU fruit fly trap (Vegetables) in bitter gourd @ 16

traps per acre during 4th week of June in case of rainy season crop. In sponge gourd, 16 traps per acre should be hanged during 4th week of June in rainy season crop. The septa of traps may be recharged after 25-30 days.

ii) Collect the infested fruits and destroy them by burying deep in the soil.

iii) Spraying the bait containing 20

ml Malathion 50 EC and 200 g jiggery or sugar in 20 litres of water on the lower surface of the leaves of maize plants grown in rows at distance of 8-10 m as trap crop has been found to be effective as the flies have the habit of resting on such tall plants.

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Beware of adulteration in milk

MANISHA BHATIA, VIPAN KUMAR RAMPAL AND GURANSHPREET SINGH SETHI

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Milk is a complete food and is an important part of our diet as it contains protein, fat, vitamins, minerals and sugar in balanced amount. Operation flood, also known as white revolution started in India in 1970. This revolution helped in increased milk production. India became the largest producer of milk with 221.1 million tonnes of milk every year. Increased milk production has not ensured the availability of quality milk to the consumers.

Milk and milk products such as curd, buttermilk and cheese are consumed in almost every household. So, it becomes important that unadulterated milk is available to every citizen of India. Adulteration of milk is a process in which some inferior substances are added to milk or some valuable ingredients are intentionally removed from the milk resulting in degradation of quality of milk. There are some common adulterants such as water, starch, urea and detergent which are added to milk. In addition to these some other adulterants such as sugar, neutralisers, vegetable oil, soda, salt, and hydrogen peroxide are added to milk to increase the volume of milk and to fetch more profits. Sodium carbonate, hydrogen peroxide and bicarbonate are added to increase the keeping quality of milk and starch is added to improve the lactometer reading and increase SNF in milk.

The addition of these adulterants to milk not only deteriorate the quality of milk but consumption of adulterated milk also effects human health. Regular consumption of adulterated milk can be harmful for human health and may lead to many life threatening

diseases including cancer. Adulteration of water, starch, urea and detergent in milk can be easily be detected at household level.

Ill-effects of milk adulteration on human health and methods to detect adulterants in milk

In addition to the methods to detect adulteration in milk which are explained in the above table, the milk adulteration testing kit is also available for testing adulteration in milk at Guru Angad Dev Veterinary and Animal Science University (GADVASU), Ludhiana. There are two types of adulteration testing kits, the small kit can be used to detect presence of starch, sugar, urea, neutraliser and hydrogen peroxide in milk and large milk adulteration testing kit can be used to detect the presence of ammonium compound, glucose, salt, pond water and formalin. To ensure the consumption of pure and unadulterated milk it is important to test the milk for different adulterants to protect the family members from ill effects of adulterated milk. The World Health Organisation (WHO) has warned that consumption of adulterated milk in India may be a contributory factor

for rising proportion of life threatening diseases in significant portion of population by year 2025.

Note: Awareness about consumption of quality milk is therefore important.

| Adulterants | Ill-effects | Method to detect adulteration |
|----------------|--|---|
| Water | Addition of water in milk reduces the nutritional value of milk. Addition of contaminated water in milk may lead to cholera, diarrhoea, typhoid and Hepatitis A. Presence of pesticides and heavy metals in water added in milk can adversely affect human health. | Pour few drops of milk on flat plate. If it flows slowly and leaves some mark on plate then the milk is pure. Milk adulterated with water flows immediately without leaving any mark on surface of the plate. |
| Starch | High amount of starch can lead to diarrhoea. Accumulation of starch in body can have serious effect in case of diabetic patients. | Add a drop of tincture iodine to milk. Formation of blue colour indicates presence of starch in milk. |
| Urea | Presence of urea in milk may lead to vomiting, nausea and gastritis. Consumption of milk adulterated with urea is harmful for kidneys and heart. | Add one spoon of milk and half spoon of soyabean powder. Mix both. Add litmus paper in the mixture after 5 minutes. If litmus paper turns blue it indicates urea in milk. |
| Detergent | Detergents contain many chemicals such as dioxine, sodium lauryl sulphate and phosphate which have many harmful effects on human health. | Take milk sample in glass and add equal amount of water in it. Shake it well. If lather forms it confirms the presence of detergent in milk. |
| Synthetic milk | Consumption of synthetic milk is harmful for the eyes. Intake of synthetic milk during pregnancy can lead to complications in pregnancy. | Synthetic milk tastes bitter and is yellow in colour. Rub milk in between the fingers. Presence of synthetic milk gives soapy feeling. |

Increase yield of *kharif* moong and mash with IPM approach

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Mungbean [*Vigna radiata* (L.) Wilczek] and mashbean (*Vigna mungo* L. Hepper) are the important pulses crops of India after chickpea and pigeonpea. Being the short duration grain legume crops with low input requirement, both *mungbean* and *mashbean* are cultivated in three different seasons viz. *Kharif*, *Rabi* and *Summer*. In Punjab, during 2021-22 of *Kharif*, *mung* and *mash* were cultivated on an area of 2.1 thousand hectares and 1.6 thousand hectares with an average yield of 9.38 and 4.41 quintals per hectare, respectively. Insect-pests are the major biotic constraints in the successful cultivation of *kharif mung* and *mash* crops. Different insect-pests like sucking insect-pests, foliage feeders and pod borers attack the *mung* and *mash* crops during the vegetative and reproductive stages. However, proper identification and management of these insect-pests can increase the



Hairy caterpillar



Blister beetle

production and improve the quality of produce. So various insect-pests, and their management measures have been discussed in this article.

Sucking Insect-pests

Whitefly, Jassid and Aphid: Both nymphs and adult stages of whitefly, jassid and aphid suck sap from the leaves, thus lowering the vitality of the plants. Symptoms of attack of these sucking insect-pests are as follows:

Whitefly and aphid excrete honey dew on which sooty mould develops, resulting in blackening of leaves and decrease in the normal photosynthesis.

In case of severe attack, there is total blackening of the crop, resulting in drying of leaves and ultimately total crop failure. Whitefly is a vector of *mungbean* yellow mosaic virus.

Management: Spray the crop upon pest appearance with 1.0 litre of homemade *neem* extract using 80-100 litres of water per acre with manually operated knapsack sprayer. To prepare *neem* extract, boil 5.0 kg mixture of *neem* leaves and fruits in 10 litres of water for 30 minutes. Then, filter this material through muslin cloth and use the filtrate for spraying at the recommended dose. Repeat the spray after one week, if necessary.

Foliage feeders

Hairy caterpillar: The body of the caterpillar is covered with hair. The caterpillar eats the green matter of leaves, leaving behind only the midribs. The crop may be totally denuded due to severe attack. When young, they feed gregariously but on a few plants in scattered spots.

Management: This pest can be

managed by using mechanical methods. Since the young larvae are gregarious, they can be destroyed by pulling out the infested plants along with larvae and burying them underground. The grown-up caterpillars can be destroyed by crushing them under feet or by picking and putting them into kerosene water. If the population is high, spray 500 ml of Ekalux 25 EC (quinalphos) in 80-100 litres of water per acre with a manually operated knapsack sprayer.

Semilooper: The larvae feed extensively on the leaves of *mash* and *moong*. The larvae are green in colour measuring 2-4 cm in length. When touched, they form a loop. In case of severe damage, the plants are totally defoliated within a few days.

Mite: The mite causes webbing on the underside of the leaves which turn pale. Such infested leaves turn light-brown to dark reddish-brown.

Foliage and flower feeders and pod borers

Tobacco caterpillar (*Spodoptera litura*): It is a polyphagous pest. The small larvae of the pest are black, whereas grown up larvae are dark green with black triangular spots on body. Its moth lays eggs in masses which are covered with brown hairs on the lower side of leaves. After hatching, first and second instar larvae feed gregariously and skeletonize the foliage. Later on, the grown up larvae disperse and feed singly. Besides leaves, they also damage buds, flowers and pods. For management of this pest, egg masses and young larvae of tobacco caterpillar feeding gregariously should be collected along with leaves and destroyed.

Taste Buds

PRERNA KAPILA AND GURUPDESH KAUR

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Pod sucking bug (*Clavigralla gibbosa*): The adults are brown-grey in colour. Both nymphs and adults use their mouthparts to pierce the pod wall and suck the sap from the developing seeds. Symptoms of damage by this pest are:

- The attack by the pest is noticeable from the white patches that appear on the surface of pods and leaves.
- As a result of continuous sap feeding, premature drying of pods is noticed.
- When such pods are opened, shrivelled and malformed seeds are observed.
- Further, such seeds easily succumb to secondary infection by fungal pathogens and pose problems in post harvesting process.
- Seeds spoiled by the pod bug neither germinate nor are acceptable as human food.
- To manage this pest, spray the crop upon pest appearance at podding stage with 1250 ml of homemade *neem* extract using 80-100 litres of water per acre with manually operated knapsack sprayer. Repeat the spray after one week, if necessary.

Pod borer (*Helicoverpa armigera*):

The larvae of the pest damage the crop by feeding on leaves, flower buds, flowers, pods and seeds in the pods, thus causing heavy loss in yield. The larvae may be pale green, yellow, brown or black in colour measuring about 3-5 cm in length when fully grown. Larval presence can be observed from damage to plant and from dark green faeces below the plants on the soil. The larvae fall on the ground when plants are shaken vigorously.

Blister beetle: Blister beetle is diurnal and general feeder. Adult beetles are robust with bright black and red stripes on the forewings. When disturbed, the beetles emit a fluid containing cantharid in that, causing blisters on human skin. The adult beetles attack *arhar*, *moong*, mash and other pulse crops. The major damage is caused at the flowering stage. They feed on tender buds and flowers of the plant, thus preventing grain formation.

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Mango is a widely popular fruit in India and has been cultivated in the country for thousands of years. India is one of the largest producers of mangoes in the world, with over 1,000 varieties of mangoes grown across the country. Mangoes are not only delicious, but they are also highly nutritious. They are an excellent source of vitamins A and C, minerals like potassium and magnesium, and antioxidant such as beta-carotene, lutein, and zeaxanthin, which are beneficial for overall health. So here are two recipes made from mangoes which can be enjoyed for tremendous health benefits.

Mango Candy

Mango candy is a sweet and chewy treat that is easy to make at home. Here is a simple recipe for mango candy:

Ingredients

2 cups ripe mango pulp (pureed), 1 cup sugar, 1/2 cup water, 1/2 tsp citric acid, 1/2 tsp salt, 1/2 cup corn flour, 1/4 cup powdered sugar



Method

- In a large pan, mix together the mango pulp, sugar, water, citric acid and salt. Stir well to combine.
- Bring the mixture to a boil over medium heat, stirring constantly. Reduce the heat and simmer for 15-20 minutes, stirring occasionally, until the mixture thickens and becomes syrupy.
- In a separate bowl, whisk together the corn flour and powdered sugar until well combined. Gradually add the corn flour mixture to the mango mixture, whisking constantly to prevent lumps from forming. Continue to cook the mixture for 5-10 minutes, stirring constantly, until it becomes

very thick and pulls away from the sides of the pan.

- Pour the mango mixture into a greased 8x8 inch baking dish and smooth the surface with a spatula. Allow the mixture to cool completely at room temperature. Once cooled, cut the mango candy into small pieces using a sharp knife or kitchen scissors. Roll the pieces in extra powdered sugar to prevent them from sticking together.
- Store the mango candy in an airtight container at room temperature for up to 2 weeks.

Mango Shrikhand

Ingredients

2 cups plain curd (strained), 1 cup ripe mango pulp, 1/2 cup powdered sugar, 1/4 teaspoon cardamom powder, A few saffron strands (optional), Chopped pistachios or almonds for garnishing



Method

- In a large bowl, take the strained curd made by hanging it in a muslin cloth for a few hours and whisk it until smooth.
- Add the mango pulp to the curd and mix well until they are thoroughly combined.
- Add the powdered sugar and cardamom powder to the mixture and mix again until the sugar is fully dissolved.
- If using saffron strands, soak them in a tablespoon of warm milk for a few minutes until they release their color and aroma. Then add the saffron-infused milk to the yogurt mixture and mix well.
- Refrigerate the shrikhand for at least an hour to allow the flavors to blend and for it to chill.

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Integrated management of gummosis and root rot diseases in citrus

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Department of Plant Pathology

Citrus is the second largest fruit crop grown over more than 50 countries commercially under different agro climatic conditions for its diversified use and increasing demand world over. It is one of the most important fruit crops of Punjab cultivated over an area of 50,195 hectares with a production of 12,23,027 MT. Among the citrus fruits, *Kinnow* ranks first with respect to area (44,752 hectares) and production (11,77,544 MT). Among the various problems, gummosis and root rot are the most serious and economically important diseases in major citrus-growing areas of Punjab. It is increasingly becoming the major limiting factor in the successful cultivation of citrus in Hoshiarpur, Faridkot, Fazilka, Bathinda and Sri Muktsar Sahib districts where citrus cultivation is a predominant horticultural activity. It causes hidden damage by decaying the feeder roots of nursery as well as grown-up plants. Gummosis and root rot is a fungal disease caused by *Phytophthora* which attacks all species and varieties of citrus being grown in Punjab. These diseases reduce the productive life span of trees, and considerably reduce fruit yield and quality. It is very essential that citrus growers pay much attention to the timely detection of these diseases and adopt integrated approaches to effectively manage them in a sustainable way for profitable citriculture. The information regarding symptoms, suitable conditions for spread of these diseases along with their integrated management approach is discussed below for the benefit of the orchardists.

Where and when do these

diseases occur?

Heavy losses occur in citrus orchards where flood irrigation is used if trees are planted on any of the susceptible rootstocks (e.g. Rough Lemon) as the water greatly spreads the fungus. Various cultural practices like low level of budding, deep planting, use of infected planting material, heavy and ill drained soil, injuries to the trunk and roots during orchard operations, piling of manure near the tree trunk, thick weed growth under the tree canopy and use of the same site for nursery raising make the trees more susceptible to the disease. Gummosis and root rot diseases commonly occur seriously during July-October following periods of high rainfall with warm temperatures. *Phytophthora* fungus infects roots and trunks under high soil moisture conditions. High susceptibility occurs when roots are stressed or damaged. Soils with drainage restricted by clay layers or those with low water table provide favourable conditions for infection of fibrous roots.

Symptoms

Gummosis: Oozing of the sap or gum from cracked portion of the bark near the base of the tree is the most diagnostic symptom of this disease and because of this symptom, the disease is popularly known as “gummosis.” Later on the rotting of the bark occurs on the trunk or crown near the ground level. The colour of the bark and wood below the bark becomes dark brown. The bark develops vertical cracks. Removal of the soil around the base of the trunk of an affected tree will show bark that appears water-soaked, slimy, and reddish-brown

to black. Foot rot lesions may develop as high as 45-60 cm from the ground level on the trunk and may extend below the soil line. The lesions may spread around the circumference of the trunk, slowly girdling the tree, leading to the death of the tree. Such girdled trees show typical pale green leaves with heavy defoliation, produce large number of flowers and die before fruit maturity. Young trees of small trunk circumference are rapidly girdled and killed.

Root rot: It causes a slow decline of citrus trees, which become clear particularly under water stress conditions. In dry season, the dead bark becomes firm, breaks away from healthy bark, curls and splits. Usually the disease is confined to feeder roots and remains unnoticed by the growers. The fungus causes a decay of feeder roots leaving only the white thread-like stele. Appearance of dull chlorotic leaves is the first symptom of such affected trees where mid-rib and main lateral veins become yellow. Such vein chlorosis is often confused with nitrogen deficiency. The diseased trees have comparatively fewer fibrous roots than healthy ones. In severe cases, where the production of new feeder roots does not keep pace with the rate of root rot, the affected trees grow poorly with sparse foliage with somewhat naked branches, stunted growth and die-back of twigs. Sometimes, these trees bear profusely and collapse when fruit are still on the trees by showing acute wilting symptoms.

Management

For effective management of the diseases, the growers should focus on



**bark cracking and
internal browning of wood**



Citrus gummosis

preventing conditions that encourage infection and disease development. Prevention through cultural practices and good sanitation is the most important step in reducing the incidence and spread of gummosis and root rot diseases. In trees affected by these diseases, fungicidal treatments are needed to minimize damage. However, fungicide applications are not expected to be highly effective if cultural practices such as judicious need-based irrigation and improved drainage system are not followed. It is important to use an integrated approach for effective and cost-effective management of gummosis and root rot diseases. The useful integrated management practices are given below:

Preventive measures: The disease is soil-borne and once it enters in nurseries and orchards, it becomes very difficult to eradicate the disease. So “prevention is better than cure”.

- Obtain the planting material from reputed nurseries. Such nurseries use containerized nursery system, sterilized potting mixture, and a separate set of nursery implements for growing plants in net/screen houses.

- Use *Phytophthora* tolerant rootstock such as Carrizo. But pH of orchard soil should be less than 8.0.

- Keep the bud union 9 inches above the ground level at the time of planting so that irrigation water does not touch the scion.

- Plant trees in well drained fields.

- Maintain good tree health. Provide only need-based irrigation. Do not give frequent heavy irrigations, as they favour rapid disease development and spread.

- Prevent flood irrigation water from reaching the trunk, as it promotes infection.

- Keep the tree basin slightly elevated to avoid water stagnation around the trunk.
- Provide a drainage ditch at the end of fields to allow excess soil water to leave the field during heavy rainfall periods.
- If possible, use drip irrigation system as it helps in proper water management to check the spread of *Phytophthora* fungus.
- Adopt proper sanitation practices in orchards. Remove weeds and grass, especially under the trees. Keep the area under the tree clean, dry and free of weeds.
- Don't pile soil around the trunk.
- Avoid using tractor-discs for removing weeds from under the trees and near the tree canopy to prevent any injury to the trunk bark and roots. Injuries provide entry points for fungal infection.
- Remove severely damaged (with more than 50% girdling) and unproductive trees from the orchard because they spread the fungus. Destroy the dead wood, to prevent it from becoming a

source of infection for healthy trees.

- Intercropping should not be done in bearing orchards. In young and non-bearing orchards, intercropping up to four years with leguminous crops such as *guara*, *moong*, *mash*, cowpea, gram and pea may be done. Do not grow incompatible crops like *berseem*, potato and creeper type vegetables in citrus orchards because these intercrops need frequent irrigations in winter which is conducive for spread of the fungus.

Chemical control

- Scrap the infected bark alongwith some healthy green part and disinfect the wounds with disinfectant solution. Collect and destroy the scrapped diseased bark to avoid further spread of the fungus in the soil. Don't keep it in the orchard. Cover the wounds with Bordeaux paste which when dries up, apply Bordeaux paint followed by spray of Bordeaux mixture (2:2:250).

OR

- Treat trunk lesions with Curzate M 8. Apply Curzate M 8 as paint (2 g/100 ml of linseed oil) to the surgical portion with the help of brush, twice in a year during February-March and July-August.
- Clean the root zone of the tree by hoeing. Dissolve 25 g of Curzate M 8 in 10 litres of water for treating one tree and drench the root zone area with the solution followed by light irrigation in February-March and July-August.

OR

- Spray sodium hypochlorite 5% @ 50 ml per tree by diluting it in 10 litres of water. Spray should be given in the foot and basin region of the trees during February-March and July-August.

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Management of fruit plants during rainy season

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Department of Fruit Science

Rainfall is one of the most essential climatic factors which influences the vigor of fruit crops. It is the pattern of rainy season that decides the plant growth and fruiting behaviour. Rainy season prevails from July to September in Punjab and is considered the best time for planting evergreen fruit plants. Excessive rains during this period results in stagnation of water in the orchards. The stagnated water poses many problems to the newly planted fruit plants as well as established orchards. The problem of water stagnation is more prominent in low lying fields. Roots need to “breathe”, and too much water can suffocate them as well as invite various fungal diseases such as root rot. The rains results in leaching of essential nutrients from soil and accumulation of salts and ultimately decline of orchards. To preserve the health of the orchards as well as to avoid the monetary loss, it is very essential to supervise the orchards properly during rainy season to get rid of such grave problems. Therefore, proper management practices should be followed in new as well as old orchards to avoid losses due to rainy season.

How to manage orchard floor during rainy season



Initial symptoms of pathological fruit drop *Fruit drop under Kinnow plant*

Stagnation of water in the orchards during rainy season may result in the death of young plants, fruit drop, increased incidence of insect-pests and diseases which ultimately affects the fruit yield and quality. Heavy rains during the month of July-September may affect the growth and productivity of the fruit crop. Some plants are highly sensitive to water logging such as water stagnation for one day can kill well established papaya plants. Mango, papaya, aonla and citrus trees are sensitive to water stagnation and cannot withstand under water logging conditions. Rains may also cause tilting of newly planted fruit plants, which need proper support with the help of stakes to keep them straight. Remove the damaged/broken limbs/branched of the plants and spray Bordeaux mixture 2:2:250.

The best way to avoid the effects of heavy rain on fruit trees is to know the soil profile of the planting site well in advance, as it is going to be the new home for the fruit trees. A well-drained site is suitable for fruit crops. Fruit trees should not be planted next to a river, pond, creek, or other water body that may flood during heavy rains. A slight slope should be provided for draining excess water while leveling of the site.

Fruit drop is the most serious problem coinciding with the rains in Punjab. The foliar applications of 5 gm 2, 4-D (Sodium salt of horticulture grade) in 500 liters of water in the months of August and September is quite effective against fruit drop. Avoid application of 2, 4-D (Sodium salt of horticulture grade) in

orchards where the broad leaf crops are cultivated as intercrops or are grown in the adjoining fields. The hormone 2, 4-D may be substituted with Gibberellic acid under such conditions.

Another serious disease in citrus orchards which is related to excessive moisture condition is *Phytophthora* (Gummosis). The affected trees show symptoms of foot rot with profuse gumming, trunk girdling, pale green foliage, stunted growth flushes and twig die-back. The management of gummosis can be done effectively by maintaining proper drainage of water and drenching of basin area of trees and main limbs with Sodium hypochlorite 5% @ 50 ml per tree in 10 liters of water. Care should be taken that the basins of tree should be free of weeds and there should be optimum moisture (*Wattar*) conditions in the field.

Besides micronutrient deficiencies, stem and fruit rot as well as scab also spreads at a faster rate during rainy season. These diseases can be effectively controlled by spraying recommended dose of fungicides before and even after the onset of monsoon season. Citrus scab can be checked by spray of Bordeaux mixture (2:2:250) starting from end June to August at 20 days interval.

Citrus psylla and leaf minor remains active during growth and development of citrus plants. These pests attack the young leaves and twigs of the plants and cause substantial damage. To manage citrus psylla application of 6.25 litre MAK HMO (Horticulture Mineral Oil) in 500 litres of water per acre can

be done.

Cracking in pomegranate, baramasi lemon and other fruit crops are associated with rains. Drain out excess amount of stagnated water from periphery of such crops. Always apply light and frequent irrigations. Mulching of tree basins with paddy straw or other crop wastes also reduce this problem. Sprinkling of water at frequent intervals can be effective to reduce fruit splitting. Remove the cracked and damaged fruits from the field regularly.

Guava bear fruits in rainy as well as in winter season. The fruit quality of the winter crop is better because of low incidence of fruit fly and fruit-borer; hence it is advised to take only the winter season crop and to avoid the rainy season crop by following crop regulation practices. For management of fruit fly in rainy season, regularly remove the infested, rotten and fallen fruits from the orchard and bury them at 2-3 feet depth. Keep the orchard clean, shallow ploughing with cultivator or rotavator is advisable immediately after harvesting. This practice is effective in exploring and killing the pupating larvae/pupae which mostly exists at 4-6 cm top soil. Keep the orchard and surrounding areas free from weeds. The fruits should be harvested on the third day after spray. Fruit fly traps @ 16 traps per acre should also be installed to manage fruit fly.

Anthraxnose disease in grapes is also directly associated with rains. Usually after harvesting of fruits, vineyards remains neglected from July-January, during which the anthracnose disease may spread in the field and cause heavy loss to the next crop. Thus, for the control of anthracnose disease, spray Bordeaux mixture (2:2:250) in January-February after pruning and again in end of March, May, July, August and September months.

Rainy season is considered as the

best time for fertilization application in fruit plants. The fertilization with nitrogenous fertilizers should be done in the month of July-August according to the age of the plants. For controlling zinc deficiency 0.47% zinc sulphate solution without addition of lime can be sprayed on the affected trees in August.

Orchard cultivation refers to the careful management of the orchard soil in such a way that the soil is maintained in a good condition suitable to the needs of the tree with least expenditure. Clean cultivation is extensively followed in the state. This involves regular ploughing and removal of weeds. Accumulation of excessive soil moisture for longer period in orchards leads to various types of biotic and abiotic stresses on the plants. Therefore, it is advised not to cultivate the orchards during monsoon season. Integrated weed management practices including manual removal of large weeds such as congress grass, bhang etc., mowing of weeds and mulching can be practiced. Therefore, to avoid the economic loss as well as to maintain the health of the orchards, it is imperative to manage the orchards properly during rainy season.

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PAU INVITES APPLICATIONS FOR INNOVATIVE FARMER AWARDS 2023

To boost crop diversification in the state as well as reward farmers for their toil, the Directorate of Extension Education of Punjab Agricultural University (PAU) has invited applications from the farmers of Punjab for the “Innovative Farmer Awards 2023.” The progressive farmers of Punjab will be honoured on the eve of PAU Kisan Mela in September 2023 for their excellence in agriculture, horticulture and allied occupations.

Sharing details, Dr GS Buttar, Director of Extension Education, informed that **Sardar Dalip Singh Dhaliwal Memorial Award**, carrying a cash prize of Rs 5,000/- along with plaque and citation, will be bestowed on the self-cultivating farmer of field crops in Punjab. **The Parwasi Bharti Award**, carrying a cash prize of Rs 8,000/- along with plaque and citation, will be presented to the self-cultivating farmer engaged in diversified farming system, he told. **Sardar Ujagar Singh Dhaliwal Memorial Award** will be awarded to the self-cultivating vegetable grower, who puts at least 60 per cent area of his operational holding under vegetable crops in winter as well as summer seasons. The award carries a cash prize of Rs 3,100 along with plaque and citation, he added. Besides, **Sardar Surjit Singh Dhillon Award**, carrying a cash prize of Rs 5,000 along with plaque and citation, will be given to the self-cultivating small farmer, having a land up to 5 acres. In addition, **Sardarni Jagbir Kaur Grewal Memorial Innovative Woman Farmer Award** will be awarded to the farm women involved in agriculture and allied agriculture enterprises in Punjab. The award carries a cash prize of Rs 3,100/- along with plaque and citation, he told.

Apart from this, village panchayat/town will be conferred with **Bhai Babu Singh Brar Pond Award** for maintaining best pond in their receptive village/town. The minimum area of the pond should be 2 kanals and 4 feet deep. Award will be given on the basis of cleanliness of water, management of pond and use of water for various purpose, he said.

Dr Buttar informed that the application forms for the awards can be obtained from Associate/Deputy Directors (Training) of Krishi Vigyan Kendras, Directors of Regional Stations, District Extension Specialists (Senior Most) of Farm Advisory Service Centres, Chief Agriculture Officers, Deputy Directors of Horticulture in different districts of the state and Directorate of Extension Education, PAU. The last date for the receipt of applications in the office of PAU Director of Extension Education is **July 14, 2023**, he added. For each award, a separate application will be accepted. Dr Buttar called upon the farmers to apply for the “Innovative Farmer Awards 2023” in time.

Role of Agricultural Technology Information Centre (ATIC) in assisting farmers

NAVJOT KAUR DHILLON AND KANWAR BARJINDER SINGH

Directorate of Extension Education

The Agricultural Technology Information Centre (ATIC) has been established by Punjab Agricultural University for single door delivery of inputs, services, technology and information. It is located in the main Campus of PAU in the office of Directorate of Extension Education. Keeping in view the need of the Punjab farmers, the PAU started a Plant Clinic in 1978 and later named as Agricultural Technology Information Centre (ATIC). The Centre is working under the direct control of Director of Extension Education by appointing expert scientists in the discipline of Agronomy, Soil Science, Entomology, Plant Pathology, Plant Breeding and Animal Science.

A Kisan Call Centre operates in the ATIC to address the direct queries of farmers. A team of scientists answers the calls. As agriculture extension workers do not reach every farmer and every farmer cannot attend agricultural fairs. Hence there is limited flow of information about the latest agri-technologies. However, there are multiple channels available for the transfer of knowledge from the laboratory to farmers. With the availability of multi-disciplinary information for integrated agricultural development and availability of technology based multimedia information systems, opportunities are available for easy transfer of knowledge from the information generators to the information users. The ATIC has a crucial role to play in bridging the technology gap between available information and information in the hands of the farmers.

To provide all information to the farmers under one roof, ATIC has been set-up along with seed shop. Seed Shop

was previously set up at Directorate of Extension Education but for the ease of farmers, nowadays Seed Shop has been shifted to Gate No. 1 of Punjab Agricultural University, Ludhiana; University is selling truthfully labelled and foundations seeds of high yielding crop varieties at this shop. Also, small vegetable kits for kitchen gardening are available at seed counter. A variety of *Rhizobium* cultures (biofertilizer) for the use in different leguminous crops to reduce nitrogenous fertilizers are available at this centre.

A special counter for the sale of farm literature for the benefit of farmers under ATIC has been set up at Gate No. 1 of PAU, Ludhiana where the monthly magazines such as Progressive Farming (English) and *Changi Kheti* (Punjabi); Package of Practices of *Kharif* and *Rabi* crops, Vegetables and Fruit crops and Animal Science; Crop Calendar; and other important publications are sold to the farmers.

Farmers are given technical know-how regarding the cultivation of crops apart from the seed. More than 10,000 farmers are getting regular guidance for redressal of their problems associated to agriculture at this centre annually. The service to the farmers is delivered free of cost.

For the identification of crop disorders, a team of experts is available in the ATIC for diagnosing the live plant samples brought by the farmers. Only after correct diagnosis of plant sample problem, farmers are given advice. To identify complex problems, scientists

of ATIC visit the farmer's field for the spot diagnosis.

The farmers can also seek the guidance from the expert scientists through telephone helpline (0161-2401960 – Extn. 417), mobile number (94630-48181), WhatsApp number (94630-48181), email (plantclinic@pau.edu) and Toll free number (1800-180-5100). This ICT technology was very useful for sending the information to expert scientist and also for getting quick solution from the scientists particularly in the Covid-19 situation. Farmers are requested to send photograph of the affected crop parts *via* WhatsApp or email for the quick redressal of the field problems. These practices offer assistance to the farmers in saving their crops from the attack of pests and diseases.

PAU digital newspaper magazine "*Kheti Sandesh*" provides scientific information to the farmers for performing timely agricultural operations. The farmers can have this weekly magazine on WhatsApp by giving a missed call at mobile number 82880-57707.

Farmers can also have information *via* following mode provided by ATIC:

- PAU *Kisan* Mobile App: <https://play.google.com/store/apps>
- PAU *Kisan* Portal – <https://www.pau.edu/fportalnew/>
- Kisan Mobile Advisor Service (KMAS)
- Exhibition-cum-Mobile Diagnostic Van
- PAU YouTube channel: <https://www.youtube.com/channel/UCa3bxtjJAu3jUnUvV1BxhXQ>

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Tips for planting and management of dragon fruit

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Dragon fruit is a perennial cactus climber. Being very hardy to soil and climatic conditions; precocious bearing, long plant life and fruiting period; tolerant to various biotic and abiotic stress factors; easy to propagate; and high nutritional value and market price made it one of the most preferred fruits worldwide. On the basis of pulp colour, primarily dragon fruit is categorized into two groups; white pulped and red pulped. Red pulped varieties are very rich in antioxidants. Consumption of dragon fruit is reported to be beneficial to cure many human ailments. Keeping in view the importance and potential of this exotic fruit crop, Punjab Agricultural University also initiated research in 2016 and recently recommended two varieties of dragon fruit viz. Red Dragon 1 and White Dragon 1 for commercial cultivation in the state.

Points to be kept in mind for planting and management of dragon fruit

1. Due to high initial investment and distinctive production technology, avoid planting large area under this fruit crop. The area may be increased in phased manner.
2. The selection of variety is one of the most important points to be considered before commercial plantation of dragon fruit.
3. The quality planting material is prerequisite for the success of the dragon fruit. Never go for the procurement of rooted cuttings or plants in polybags from the other states as these may have nematode infestations, which is very difficult to manage once spread in the orchard soils. Always prefer matured cuttings of dragon fruit as these will be cost effective as well as free of nematodes.
4. Though the dragon fruit can be grown on wide variety of soils, however sandy-loam soils with good drainage and rich in organic matter are highly suitable for its cultivation. Avoid cultivation on extremely sandy soils and soils with poor water drainage.
5. Dragon fruit is also hardy to climatic conditions; however, extreme heat and frost may cause damage. It is light loving plant. Always select the suitable site for its plantation. To lessen extremes of climatic factors, the site adjoining to the tall trees may be selected or wind breaks may be erected for this purpose.
6. Planting of dragon fruit can be done in February-March and July-September. As the dragon fruit is a climbing cactus, it requires proper and strong training system. Generally, single pole system or trellis system can be established for its training. In single pole system, poles can be fixed at 10x10 feet or 12x8 feet distance and at each pole site, 4 plants can be planted on the each side of the pole. Trellis system can also be used; however it should be strong enough to bear heavy weight in future.
7. The dragon fruit plants are fast growing climbing cactus and produce dense branches during the initial stage. The lateral buds and branches should be regularly pruned to grow towards pole and these should be tied with plastic string. Once the plants reach up to the top of the stands, the side branches are then allowed to grow by removing the terminal portion of the main stem so that it may form an umbrella like structure. Likewise, in trellis system, train the plants with bamboo sticks or splits to aid them to reach the wires. Regularly remove the shoots arising on the sides of the main plant.
8. Organic matter in the form of well rotten farm yard manure or *gobar* gas slurry plays a key role in dragon fruit plant growth and fruit development. Each pole should be applied with 10 to 15 kg of organic manure at the time of planting. Application of chemical fertilizers should be practiced as per PAU recommendations. Applications of organic manures can be done in January-February in case of established plantations.
9. Though the dragon fruit belongs to *Cactaceae* family, however, it requires light and frequent watering under sub-tropical climate from March to June. Drip irrigation system must be used to maintain soil moisture during plant growth and fruit development period.

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Importance of lighting management in poultry production

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Krishi Vigyan Kendra, Ropar

Poultry egg production is associated with the length and intensity of the light received by the bird daily. In humans, light reaches the brain through the eyes. In poultry birds, light penetrates not only through the eyes, but also through the skull (via the pineal gland and through the pituitary gland), skin and feathers. It stimulates the anterior lobe of the pituitary gland through optic nerve for the release of Follicle stimulating hormone (FSH) and Leutinizing hormone (LH). FSH increases the growth of the ovarian follicles. Upon reaching maturity, the ovum is released by the action of LH.

Like humans, poultry birds' lives revolve around a regular day-and-night cycle. When birds have a proper day and night cycle, they develop proper diurnal rhythms – that is, a routine of typical activities during the day. It drives immune function, growth rate and reproductive hormones. Another important aspect is the visual capacity of birds, which influences their development, the search for food and water, and behavioral and social interactions which get facilitated with availability of artificial light during dark time. Hence an efficient day-and-night cycle improves the health, reproduction and immune system.

Aim of the Lighting program

1. Stimulates feed intake and growth.

2. Influences the timing of sexual maturity.
3. Maximizes egg numbers.
4. Optimizes egg weight.
5. Influences time of egg laying.
6. Controls undesirable behaviour.

Importance of intensity and duration of light in poultry farm

Light intensity

Light intensity (measured in lux or foot candle) is the **amount or power of light emitted by a source (1 ft candle=10 lux)**. It is highly important aspect of poultry farm management. Higher light intensities in continuous light programme have negative effects on health, increase eye problem, increase mortality and induce aggressive pecking behaviour in birds. It was also found that higher light intensities increase physical activity and reduce leg abnormalities. Low light intensity increases feed conversion and promotes higher body mass in birds. Low intensity light also increases eye problems and compromises welfare among birds.

Duration of light

Day light occurs from 15 to 30 minutes before sunrise and darkness occurs 15 to 30 minutes after sunset, thus the length of light day is somewhat longer than the

hours between sunrise and sunset. The time duration for which light (naturally through sun light + artificially through bulbs) is allowed in a poultry shed is the duration of light. Light stimulation (usually an increase of as little as one hour) has an immediate effect on the production of reproductive hormones.

Wavelength of light

While humans respond to light from around 400–750 nm, chickens can see UV-A light (315–400 nm) in addition to 400–750 nm. Overall, pullets may be reared with warm or cool lights, but laying hens should have lights with a sufficient red spectrum (2700 K–3000 K).

Types of light sources: There are four common light types used in poultry houses are:

- **Incandescent** – they more or less like a small fire inside a glass bowl. They are cheap; but have short bulb life (750-1000 hrs).
- **Fluorescent** – 3 to 4 times more efficient than incandescent bulbs; 10 times longer life than incandescent bulb.
- **Mercury vapor** – Long life (24,000 hrs); requires several minutes to warm up; cannot be used in houses with low ceilings.

Compact Fluorescent (CF) Lighting

– More energy efficient. One-fifth energy of fluorescent light is needed to provide same light intensity (lumen).

Cost effective and energy-efficient lighting options give new opportunities to reduce electricity costs and help manage farms sustainably. Hence these lights can be used to improve productivity and safety, and reduce operating costs.

Importance of light for broilers

- Lighting patterns for broilers are aimed mainly at stimulating or controlling feed intake. Continuous lighting at 30-50 lux for 1-5 days, followed by 1 hour of darkness and 23 hr light at 5-10 lux is the most commonly used programme.
- Broiler behaviour is strongly affected by light intensity. Generally, brighter light will foster increased activity, while lower intensities are effective in controlling aggressive acts and cannibalism.
- Importance of light for growers
- Decreasing the length of light day during growing period will lead to:
- Increase the age at sexual maturity.
- Increase the number of eggs laid during the first half of the egg production (but not in total number of eggs laid).
- Increase the size of the first eggs produced.
- Light restriction alone delays the sexual maturity at the maximum of three weeks. If feed restriction is combined with light restriction, we can delay it up to four weeks period.

Light effects during laying period

Birds reared under increased day-light produce more eggs due to the

release of FSH and LH from the pituitary. Brightness of light also has influence on egg production. On practical conditions, 10 lux light intensity is needed in layer houses. In multi-deck cage system, minimum of 5 lux light intensity is needed at the lower deck. For maximum egg production, 16 hours light is needed during peak egg production period. A 40 watt bulb if hanged at height of 7 feet, will be sufficient for 200 square feet floor space. In general the light intensity for layers should be enough to read a newspaper. Reducing photoperiod during laying period seriously affects egg production. The artificial light can be given either in the morning, evening or both morning and evening.

As a general rule, decreasing light duration pattern is utilized for growing pullets and increasing light duration is used to stimulate layers. Light stimulation (usually an increase of as little as one hour) has an immediate effect on the production of reproductive hormones. It is ideal to reach the standard level 16 hours of light by 30–35 weeks to help prolong peak production. Light intensity **below 5 lux** is too dark to stimulate proper growth and production, while higher light intensity (above 50 lux) may cause nervousness and aberrant behavior. The standard recommendation for growing pullets is to brood for 2 to 3 weeks at 30–50 lux (3–5 fc), and then dim to 10–15 lux (1–1.5 fc) until 14 weeks. Two weeks prior to the transfer to layer house, gradually increase the light intensity to match the levels in the layer house.

Intermittent lighting programs have also been considered as an alternative for poultry broiler and layer farming. The increase in bird rest time and the greater production of melatonin have been shown to exert a positive influence on immunity, energy conservation, and feed conversion.

Some important facts to be kept

in mind

- The manner in which lights are installed in the poultry house has a role on their efficiency. Some of the important points regarding fixing bulbs in poultry houses are,
- The distance between bulbs should be 1½ times the distance from the bulb to the bird level.
- The distance from the bulbs to the outer edges of the house should be only ½ the distance between bulbs.
- In cage system, the bulbs should be placed in such a way that their rays fall on the feed and the birds.
- Clean reflectors increase the light intensity at bird level by 50 per cent, compared with no reflector.
- Avoid cone shape reflectors since they confine the light rays to limited area. Better to use flat type reflector with rounded edge.
- In case of deep litter system, the bulb is to be placed at 7-8' height whereas in cage house, keep in aisle.
- Avoid hanging bulbs by a cord in open houses.
- Very dirty bulbs emit about 1/3 less light than clean bulbs.
- Light bulbs should be cleaned once in two weeks.
- Even, non flickering lights with facility of dimming are ideal for birds.
- Light plays an important role in poultry industry, as optimum lighting condition not only increases production efficiency but also takes care of the welfare issues of the poultry birds. Thus, it can be concluded that a scientifically chalked out plan of lighting not only saves electric consumption, but also results in better production.

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Initiative to encourage farmers to adapt to climate change

NAVJOT KAUR DHILLON AND RAHUL KAPOOR

Plant Breeding and Genetics

To ensure food and nutritional security for growing population, climate change has become an important area of concern for India. The Prime Minister's National Action Plan on climate change has acknowledged agriculture as one of the eight national missions. A network project of the Indian Council of Agricultural Research (ICAR) and National Innovations on Climate Resilient Agriculture (NICRA) was launched in February 2011. The aim of the project is to enhance resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration. The interventions in the village panchayats are decided following a participatory approach through the Village Climate Risk Management Committee (VCRMC), after the PRA to assess the climate related problems in the village and baseline survey. The program was commenced formally in all the villages by involving the state line department functionaries and leaders of the panchayats to make sure local ownership of the project from the beginning and convergence of related schemes currently in operation in the panchayat.

The interventions in each village are made in the following four modules; firstly, natural resources module of interventions is associated to *in-situ* moisture conservation, improved drainage in flood prone areas, water harvesting, supplemental irrigation, conservation tillage with appropriate, artificial ground water recharge and water saving irrigation methods. Secondly, crop production comprises introducing flood/drought/temperature tolerant varieties,

advancement of planting dates of *rabi* crops in areas with terminal heat stress, water saving paddy cultivation methods (direct seeding, SRI, aerobic,), frost management in horticulture through trash burning, community nurseries for delayed monsoon, custom hiring centers for timely planting, and location specific intercropping systems with high sustainable yield indicators. Thirdly, Livestock and Fisheries: This module utilizes community lands for fodder production during droughts/floods, improved fodder/feed storage methods, preventive vaccination, improved shelters for reducing heat stress in livestock, management of fish ponds/tanks during water scarcity and excess water, etc. Fourthly, Institutional Interventions: This module consists of institutional interventions either by intensification of the existing ones or initiating new ones relating to commodity groups, seed bank, fodder bank, custom hiring centre, collective marketing, introduction of weather index based insurance and climate literacy through a village level weather station. The unique features of this project are setting up of custom hiring centers in all the 100 villages and formation of Village Climate Risk Management Committees.

Technologies such as on-farm water harvesting in ponds, supplemental irrigation, introduction of early maturing drought tolerant varieties, paddy varieties tolerant to sub-mergence in flood prone districts, improved drainage in waterlogged areas, recharging techniques for tubewells, site specific nutrient management and management of sodic soils, mulching and

use of zero till drills were enthusiastically implemented by the farmers in NICRA villages across the country. The intervention which found tremendous support across the country is the custom hiring centres. Many such centres are opened across the country and this intervention posed several research problems which were not anticipated like lack of farm machinery in some villages and the difficulty in using tractor drawn implements.

The technology demonstration component consists of role of KVKs. Under this component, an integrated package of proven technologies would be demonstrated in one village panchayat in each district for adaptation and mitigation of the crop and livestock production systems to climate variability based on the available technologies. The selection of districts for technology demonstration is done on the basis of long term data analysis of climatic constraints of village regarding assessment of the natural resources status of the village, identification of major production systems and studying of existing institutional structures, and identifying gaps focus group discussion with the community to finalize the interventions.

Under NICRA project, Zone-I has four states namely Punjab, Himachal Pradesh, Jammu and Kashmir and Uttarakhand. The NICRA project initiated in 2011 for XII Five Year Plan and was extended up to March 2020 (Phase II) and the KVKs were now to extend their activities in nearby villages for demonstration of climate resilient technologies.

In Punjab, Bathinda, Faridkot, Fatehgarh Sahib and Ropar district, KVKs adopted villages. Bathinda and Faridkot districts have been selected for high temperature, depletion of ground water and heat wave, whereas, Ropar and Fatehgarh Sahib districts are selected under frost/cold wave climatic vulnerability. All these districts demonstrated the technology of Happy Seeder/zero tillage sowing of wheat in the standing paddy residues which provides an alternative to the residue burning. The management of paddy residue with Baler-cum-knotter was demonstrated in the NICRA villages as an option for paddy straw management. Also, the farmers are able to sow their wheat crop one week earlier as compared to traditional practices followed by farmers as burning of paddy straw and tillage. Besides, the farmers are earning handsomely by selling the bales to the thermal plant, cardboard factory, briquetting units, etc. Under NICRA project, demonstrations were conducted on laser land levelling on farmers' fields in rice-wheat systems to promote this resource conservation technology and inculcate a habit of optimum resource utilization among the farmers of Punjab. Laser Land Leveller helps in uniform application of irrigation water, thereby saving irrigation water up to 10-15% and resulting in 2-5% increase in yield.

Drought/temperature tolerant varieties wheat varieties HD 3086, HD 725, Unnat PBW 343 and Unnat PBW 550 under NICRA project by KVK, Faridkot demonstrated temperature tolerance in farmer's fields. Short duration varieties of summer green gram are a short duration crops which fit in paddy-wheat rotation, not only give an additional income to the farmer but also help in improving soil health through incorporation of crop residue and fixing atmospheric nitrogen. Also, demonstrations of low water requiring short duration varieties of paddy, namely Pusa Basmati 1509 and PR 126 were conducted by KVK, Fatehgarh Sahib.

The short duration varieties also provide a little wider window between paddy harvesting and wheat sowing, thereby helping farmers to evade burning of crop residues. Direct Seeded Rice (DSR) is an irrigation water saving option to the transplanted paddy in which problems like labour shortage during peak demand can be avoided. The DSR not only gives the flexibility to take up direct sowing of paddy with a suitable duration variety to fit into the left over monsoon season but also allows timely sowing of wheat in the next season as well. Farm Yard Manure pits were established in NICRA villages to provide quality manure for the farmer's field for improving soil health, fertility and productivity. The NICRA demonstrations on mulching in sugarcane were organized for *in-situ* moisture conservation measure in Faridkot district. Demonstrations revealed that the mulching saves 2-3 irrigations in the farmer's fields along with as much as 40% reduction in the weed infestation. The NICRA intervention of green manuring improved physical condition as well as fertility status of soil. This practice results in saving of 25 kg of N (55 kg urea) per acre. Use of Tensiometer demonstration for scheduling irrigation to the paddy (PR-114) crop in the farmer's fields of NICRA village of Faridkot reported saving of 4-6 irrigations during 2016-17 and 2017-18, and 3-4 irrigations in 2018-19.

The KVKs under NICRA project installed biogas plants for alternate source of energy reduced the usage of fuel wood, kerosene, etc. The technology also leads to production of quality organic manure, helps in environmental sanitation, reduction in drudgery and lowers the greenhouse emissions. For crop diversification, KVK, Bathinda organized demonstrations on cultivation of mustard (GSC-7, PBR-357), gram (GPF-2, PBG-7) and summer green gram (SML-668) to popularize crop diversification in the NICRA villages. Farmers reported

better yield performances of improved varieties of pulses and oilseeds and started considering them to be part of traditional cropping system. In NICRA villages, the promotion of high yielding improved cultivars of fodder resulted in extended fodder availability up to summer season, thereby resulting in milk production in dairy animal to the tune of 12-13lt/day as compared to 10-11 lit/day of without intervention. The KVK promoted silage making of green fodder in NICRA villages to ensuring fodder availability during lean periods for developing sustainable climate resilience agriculture. Cultivation of fodder maize, sorghum and oats demonstrations to prepare silage using plastic drums and silo pits were of much help. Feed supplementation intervention under NICRA project like Mineral mixture and uromin licks to combat nutrients deficiency in dairy animals resulted in improvement in not only in production and reproductive health of the dairy animals but also improved immunity status and helped animals overcome heat stress.

The KVK team for each district conceded a comprehensive exercise on the needs of the village, the climatic vulnerability (drought/floods/heat wave/frost/cyclone) and the available technology options. After a vigilant study of the gaps, specific interventions from each of the module were selected and an integrated package from all modules was formulated. Majority farmers have been covered with one or more of the interventions in order to demonstrate a discernable effect. These demonstrations supported with capacity building programs and extension activities popularize selected technologies and enable their adoption in the adopted as well as the nearby villages. As an outcome of this exercise, location specific climate resilient practices and constraints in its adoption have been documented.

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Farm operations in August

PADDY

1. To the rice crop, irrigation should be given two days after the ponded water has infiltrated into the soil but fields should not be allowed to develop cracks. Last dose of nitrogen (30 kg urea/acre) may be applied if already not given. If urea is to be applied with the help of leaf colour chart, apply 25 kg urea/acre only if 6 leaves out of 10 are lighter than shade no 4 of leaf colour chart. In direct seeded rice (DSR) apply second and third dosage of about 43 kg urea/acre each at 6 and 9 weeks of sowing.
2. In highly deteriorated soils, zinc deficiency may appear in patches even after the application of recommended dose of zinc sulphate. In such cases apply an additional dose of 10 kg zinc sulphate (21%) or 6.5 kg zinc sulphate (33%) per acre mixed with equal amount of dry soil, on the affected area.
3. Iron deficiency may appear in sandy soils. The deficient plants show yellowing of younger leaves which ultimately turn white. To correct this malady, 1.0% ferrous sulphate solution (one kg ferrous sulphate in 100 litres of water per acre) may be sprayed 2-3 times at weekly intervals. Do not apply ferrous sulphate to soil.
4. In early transplanted crop, drying of leaves due to bacterial leaf blight disease may be noticed. Spray with any chemical will not be helpful to control this disease. Do not pond water in the field. Addition of nitrogen will further increase the disease.
5. Sheath blight may be noticed during the month of August. The disease can be checked by spraying Pulsor/ Iglare 24 SC @ 150 ml or Epic 75 WG @ 26.8g or Galileo Way 18.76 SC @ 400ml or Amistar Top 325 SC @ 200 ml or Nativo 75 WG @ 80 g or 320ml Lusture 37.5 SE or Folicur/Orius 25 EC @ 200 ml or Tilt/Bumper/Pikapika 25 EC or Monceren 250 SC 200 ml in 200 litres of water. Keep the bunds clean by removing weeds.
6. To check false smut spray the crop with Gallio way 18.76 SC @ 400ml or Kocide 46 DF @ 500 g in 200 litres of water per acre at boot stage in disease prone areas.
7. Rice Stem Borers: The larvae bore into the stems of young plants and result in dead

hearts. The fields showing more than 5 per cent dead hearts (ETL) should be sprayed with 20 ml Fame 480 SC (flubendiamide) or 50g Takumi 20WG (flubendiamide) or 60 ml Coragen 18.5 SC (chlorantraniliprole) or 170 g Mortar 75 SG (cartap hydrochloride) or 80 ml neem based bio-pesticide, Ecotin (azadirachtin 5%) in 100 litres of water per acre. These insecticides may be repeated as and when damage reaches economic threshold level. Prefer Ecotin at pest initiation stage. In basmati rice, when there are more than 2% dead hearts, apply Fame 480 SC @ 20 ml or Takumi 20WG @ 50g or Coragen 18.5 SC (chlorantraniliprole) @ 60 ml or Mortar 75 SG @ 170g or one litre of Coroban/Dursban/Lethal/ Chlorguard/ Durmet/ Classic/ Force 20 EC or Ecotin @ 80ml/acre or Achook/ Neem Kavach @ 1 litre in 100 litre of water per acre. In addition to these insecticides, Ferrera 0.4 GR (chlorantraniliprole) @ 4 kg or Padan/Caldan/Kritap/ Sanvex/ Nidan/ Marktap/ Miftap/ Katsu 4G (cartap hydrochloride) @ 10 kg/acre or Vibrant 4 GR (thiocyclam hydrogen oxalate) @ 4 kg or Regent/ Mortel/Mipro-G/ Mahaveer GR/ Shinzen 0.3 G (fipronil) @ 6 kg per acre can also be used in standing water in basmati rice. These insecticides also control leaf folder in addition to stem borers.

8. Leaf Folder: The larvae of this insect fold the leaves, eat out the green tissues and produce white streaks. Before flowering, the leaf folder damage can be controlled by passing a 20-30 m long coir/jute rope, forwards and then backwards, both ways while touching the crop canopy. While passing the rope, please ensure that water must be standing in the crop. When the leaf damage reaches 10 per cent (ETL), this pest can be controlled by spraying 20 ml Fame 480 SC or 50g Takumi 20WG (flubendiamide) or 60 ml Coragen 18.5 SC (chlorantraniliprole) or 170 g Mortar 75 SG or 80 ml neem based bio-pesticide, Ecotin (azadirachtin 5%) in 100 litres of water per acre.
9. Plant hoppers: The nymphs and adults of planthoppers suck the cell sap particularly from the leaf-sheath from July to October.

These can be controlled by spraying the crop with 94 ml Pexalon 10 SC (triflumezopyrim) or 80 g Osheen /Token/Dominant 20 SG (dinotefuran) or 120 g Chess 50 WG (pymetrozine) or 400 ml Orchestra 10 SC (benzpyrimoxan) or 300 ml Imagine 10 SC (flupyrimin) or 800 ml of Ekalux/Quinguard/ Quinalmass 25 EC (quinalphos) or 80 ml Ecotin or 4 litre PAU Homemade Neem Extract in 100 litres of water per acre. For better results use knapsack sprayer while directing its spray towards the base of the plants. Prefer Ecotin or PAU Homemade Neem Extract at pest initiation stage.

MAIZE

1. Adequate supply of water is essential for proper growth of crop. However, maize is very sensitive to standing water, so excess water may be drained out from the field which would also help to keep stalk rot under control. Damage due to standing water can be minimized by two sprays of 3 per cent urea solution at weekly interval or by applying additional nitrogen @ 12-24 kg (25-50 kg urea) per acre in case of moderate to severe damage after the flooding is over.
2. Apply last dose of nitrogen i.e. 37 kg urea per acre to early sown hybrids or high yielding varieties of maize at the appearance of tassels. Apply 25 kg urea per acre to local maize/Pearl Popcorn/ Kesri.
3. To control banded leaf and sheath blight of maize, spray 100ml of Amistar Top 325 SC in 200 litres of water as soon as it appear in the field.
4. The attack of maize borer can be checked by spraying with 30 ml of Coragen 18.5 SC (chlorantraniliprole) in 60 litres of water per acre with knap-sack sprayer. Bioagent Trichogramma chilonis can also be used to controls this pest. Use trichocards having 40,000 eggs of Corcyra cephalonica parasitized by T. chilonis, twice per acre; first release on 10 days old crop and second 7 days after the first release.

COTTON

1. To keep weeds under check, give hoeing. Apply 33 kg urea/acre to varieties, 45 kg/

- acre to Bt cotton on the appearance of first flower. Use PAU LCC for need based urea application. Apply 4 sprays of 2% potassium nitrate (13:0:45) solution at weekly intervals, starting at flower initiation.
2. Spray against whitefly should be done when population reaches 6 adults per leaf in the upper canopy of plants before 10 AM with Sefina 50DC (afidopyropen) @ 400 ml/acre or Osheen 20 SG (dinotefuran) @ 60 g/acre or Polo/Craze/Ruby/Ludo/Shoku 50 WP (diafenthiuron) @ 200 g/acre or Lano/Daita 10 EC (pyriproxyfen) @ 500 ml or Oberon/voltage 22.9 SC (spiromesifen) @ 200 ml/acre or Ulala 50 WG (flonicamid) @ 80 g/acre or Dantotsu 50 WG (clothianidin) @ 20g or Fosmite/Volthion/Goldmit/E-mite 50 EC (ethion) @ 800 ml/acre or PAU Homemade Neem Extract @ 1200 ml/acre or Nimbicidine/Achook (neem based) @ 1 litre/acre. Initiate spray against jassid when ever some of the fully formed leaves in the upper canopy show yellowing and curling at the margins on 50 percent on the plants. Use Keefun 15 EC (tolfenpyrad) @ 300 ml/acre or Ulala 50 WG (flonicamid) @ 80 g/acre or Osheen 20 SG (dinotefuran) or Neon 5 EC (fenpyroximate) @ 300 ml/acre or Actara/Extra Super/Dotara/Thomson 25 WG (thiamethoxam) @ 40 g/acre in 125-150 litres of water.
 3. Attack of mealybug can be checked by spraying 150 ml Transform 21.8 SC (sufloxaflor) using 125-150 litres of water per acre. To protect the crop from bollworm and tobacco caterpillar damage, the insecticides given for the control of bollworm and tobacco caterpillar in Table 1 are recommended. These should be sprayed using 125-150 litres of spray material per acre with manually operated knapsack sprayer or 75 litres with the shoulder mounted power sprayer and tractor mounted sprayer when the damage in shed fruiting bodies exceed 5% and thereafter spray as and when need arises.

Note:

- a. Regularly monitor the pest population.
- b. For effective insecticide resistance management, do not repeat the insecticide of same group in subsequent sprays.
- c. Do not use mixture of insecticides as these will result in faster development of resistance and resurgence of pests.
- d. Do not use synthetic pyrethroids on cotton for the control of bollworm complex after mid September.
- e. Repeat the spray immediately if it rains within 24 hours after spray.

- f. Cotton is highly sensitive to the 2, 4-D weedicide. Some farmers spray the ester form of 2, 4-D for controlling weeds in maize grown near the cotton fields. Owing to the volatile nature of 2,4-D ester, its vapours cause serious injury to the cotton crop. Hence avoid the application of this herbicide in maize, if cotton is grown in the adjoining fields. The other precautions are:
 - a. After using 2,4-D fill all spraying equipments as well as tubs, buckets, etc. with 0.5 per cent washing soda solution (500 g of washing soda in 100 litres of water) in the evening. Next morning, flush all equipments thoroughly with fresh water.
 - b. To avoid the use of contaminated insecticides on cotton, it is advisable to test insecticide at least two weeks in advance on a few plants. If the insecticide is contaminated with 2, 4-D, the tender leaves and shoots could become distorted and lanceolated within 10 days. Reject such an insecticide.
 - c. To control fungal foliar leaf spots, the crop should be sprayed with Amistar Top or 200 ml/acre in 200 liters of water at 15-20 days interval.

SUGARCANE

1. To prevent lodging, prop up the crop at the end of this month by using trash twist method.
 1. Iron deficiency is observed both in the ratoon and plant crop on light textured and calcareous soils. Deficiency symptoms first appear on young leaves as yellow stripes between the green veins, later the veins also turn yellow. In severe cases, leaves become white and the plants remain stunted. To correct this deficiency, 1 % ferrous sulphate solution (one kg ferrous sulphate in 100 litres of water per acre) may be sprayed 2-3 times at weekly intervals soon after the symptoms appear.
 2. Release bio-agent, *Trichogramma chilonis* @ 20,000 per acre from July to October (10-12 releases) at 10 days interval for the management of stalk borer in sugarcane. Use 10 pheromone traps per acre along

Insecticides for the control of bollworms in cotton

| Brands (insecticides) | Dose/acre |
|---|-----------|
| Pink and Spotted bollworms | |
| A. Synthetic Pyrethroids | |
| Danitol/Meothrin 10EC (fenpropathrin) | 300ml |
| Fastac/Alphagaurd/Merit Alpha 10 EC (alphamethrin) | 100 ml |
| Bulldock 0.25 SC (β-cyfluthrin) | 300 ml |
| Ripcord/Bilcyp/Bullet/Ustad/Cypergaurd 10 EC (cypermethrin) | 200 ml |
| Cymbush/Cyperkill/Hilcyper/Colt/Basathrin/Agrocyper/Cypergaurd 25 EC (Cypermethrin) | 80 ml |
| Decis/Rukrain/Decicare 2.8 EC (deltamethrin) | 160 ml |
| Sumicidin/Fenval/Agrofen/Fenlik/Triumph card/SB Fenvalerate Milfen/Markfenval 20 EC (fenvalerate) | 100 ml |
| Pink, Spotted and younger larvae of American bollworm | |
| Macrocyclic lactones | |
| Proclaim 5SG | 100 g |
| B. Carbamates | |
| Larvin 75 WP (thiodicarb) | 250 g |
| B. Organophosphatic | |
| Curacron/Carina/Profex/Celcron 50 EC (profenophos) | 500 ml |
| Fosmite/E-mite/Volthion 50 EC (ethion) | 800 ml |
| C. Miscellaneous group | |
| Fame 480 SC (flubendiamide) | 40 ml |
| Grown up larvae of American bollworm | |
| A. Naturalyte | |
| Tracer 48 SC (spinosad) | 60 ml |
| B. Oxadiazine | |
| Avaunt 15 SC/Avaunt 15 EC (indoxacarb) | 200 ml |
| C. Miscellaneous group | |
| Sumipleo 10 EC (pyridalyl) | 300 ml |
| Coragen 18.5 SC (chlorantraniliprole) | 60 ml |
| D. Organophosphates | |
| Coroban/Dursban/Durmet/Chlogaurd/Lethal/Force/Markpyriphos 20 EC (chlorpyriphos) | 2 litres |
| Orthene/Asataf/Starthene/Markphate 75 SP (acephate) | 60ml |
| Tobacco caterpillar | |
| A. Insect Growth Regulator | |
| Rimon 10 EC* (novaluron) | 150 ml |
| C. Miscellaneous group | |
| Coragen 18.5 SC (chlorantraniliprole) | 60 ml |

- with the recommended Tricho cards application from July to October. Change the pheromone lures at one-month interval.
3. Collect and destroy the infected shoots affected with different borers particularly that of Gurdaspur borer at weekly interval regularly to prevent further infestation

of the healthy canes.

4. For the management of Sugarcane Pyrrilla, use Dursban 20EC (chlorpyrifos) @ 600 ml/acre in 400 litre of water.

FODDER PRODUCTION

1. Sow leguminous and non-leguminous crops in mixture to improve the nutritive value of the fodder i.e. maize + cowpea, sorghum + guara.
1. Apply 30 kg N (66 kg urea)/ acre to the multicut fodder (napier bajra hybrid and Guinea grass) after every cutting.
2. For controlling *itsit/chaupatti* in maize, spray Atrataf 50 WP (atrazine) within 10 days of sowing @ 800 g/acre on medium to heavy textured soils and 500 g/acre in light soils by using 200 litres of water . Do not use atrazine in fodder maize after 15th August sown crop as late application will have residual toxicity effect on the succeeding crops like wheat, berseem etc. Atrazine should not be used where maize fodder is sown in mixture with cowpea.
3. Harvest the fodder crops at optimum stage like maize at milk ripe stage, bajra at flagleaf stage, napier bajra or guinea grass at one metre height and sorghum at pre-flowering to flowering stage to obtain maximum nutrients for the milk production.
4. Conserve surplus fodders like maize, sorghum, napier bajra, guinea grass as silage to be used in lean periods for cheap milk production.

GENERAL PESTS AND WEEDS

1. The weeds in non-cropped areas like on farm, roads, water channels etc. can be controlled by spray of gramoxone 24SH (Paraquat dichloride) @ 250 to 500 ml in 100 litres of water. Alternatively spray roundup/genki SH (glyphosate) @ 700 ml or Excel Mera 71 SG (glyphosate) @ 400g in 100 litres of water.

Parthenium (Congress grass/Carrot grass)

It is a problem weed of waste places, orchards and plantation crops. It makes luxuriant growth during this period. Check this weed through mechanical means such as repeated cuttings and hand weeding but during hand weeding kindly wear gloves as this weed cause severe allergic problems. .

VEGETABLES

Cauliflower : Sow 250 g seed of mid season varieties in one marla bed area. Irrigate the nursery beds daily with a watering can daily in the beginning and thrice a week there after. Treat the seed with 3 g Captan per kg of seed before sowing.

Root crops : From the last week of this month, start sowing Asiatic (*Desi*) varieties of radish (Pusa Chetki), carrot (PC 161, PCP-2, PCY-2,

Punjab Black Beauty and Punjab Carrot Red) and turnip (L-1). Before sowing, add 15 tonnes FYM, 55 kg urea and 75 kg single superphosphate per acre. Apply 50 kg muriate of potash per acre to carrot only. Prepare ridges 45 cm apart and dibble seed in fully moist conditions at 7.5 cm spacing. Apply light irrigation immediately after sowing. Use 4-5 kg seed of radish and carrot and 2-3 kg seed of turnip to sow an acre.

Chilli

1. Harvest red ripe fruits once a fortnight to minimize shedding in the fields. Fully developed green fruits may be plucked for use as a *salad* and pickle.
2. For control of fruit rot and die back, spray the crop with 250 ml of Folicur or 750 g of Indofil M 45 or Blitox in 250 litres of water per acre at 10 days interval.

Brinjal and Okra

1. Spray 80ml Coragen 18.5 SC (chlorantraniliprole) or 80g Proclaim 5 SG (emamectin benzoate) or 100 ml Somicidin 20 EC (fenvalerate) or 200 ml Ripcord 10 EC (cypermethrin) in 100-125 litres of water against fruit and shoot borer of brinjal.
2. In brinjal, spider mite attack can be minimized by spraying 300 ml O-mite 57 EC per acre in 150 litres of water.
3. The attack of jassid on *bhindi* can be reduced by spraying 80 ml Ecotin 5% or 2 litre PAU Neem extract or 40 ml Confidor 17.8 SL (imidacloprid) or 40g Actara 25 WG (thiamethoxan). For control of spotted bollworms, give 3 sprays at fortnightly intervals with 50 ml Coragen 18.5 SC (chlorantraniliprole) or 200 ml Sumipleo 10 EC (pyridalyl) or 70 g Proclaim 0.5 SG or 100 ml of Somicidin 20 EC using 100-125 litres of water per acre, as soon as flowering starts.

Onion

During this month start planting *kharif* onion crop both with bulbsets as well as seedlings. Apply 45 kg urea, 125 kg single superphosphate and 35 kg muriate of potash per acre before planting. Transplant seedlings at 15 × 7.5 cm distance and irrigate the field immediately after transplanting.

HORTICULTURAL OPERATIONS

1. It is very suitable time for planting of evergreen fruit plants like citrus, mango, guava, litchi, loquat, sapota etc.
2. The excess rain water when stagnates for several days is harmful to the orchard trees. Adopt prompt measures to drain out excess rain water from the orchard. Root damage due to water stagnation in pear, peach can be managed with immediate draining of excess water from the root zone followed

by hoeing at optimum moisture (*wattar*) conditions. Prune the dried ends of the branches along with 5-8 cm of the live wood.

3. Spray the affected citrus trees with 0.47% (4.7g/ liter of water) zinc sulphate without addition of lime to late summer flush to control zinc deficiency. To correct zinc and manganese deficiency, spray the plant with zinc sulphate (470 g) + manganese sulphate (330g) in 100 liters of water. A gap of one week should be kept between the foliar application of Bordeaux mixture and zinc sulphate and manganese sulphate solution.
4. The physiological fruit drop in citrus can be checked by spraying 2,4-D sodium salt of Horticultural grade (5g) in 500 liters of water/acre in mid August.
5. To control foot rot (*Phytophthora*) of citrus, give one application of Curzate M8 as paint to the infected trunk portion and drench (25 g/10 litres of water/ tree) the soil at the base of the tree in July-August or drench the soil and main limbs of the affected plants with sodium hypochlorite (5%) @ 50 ml in 10 liters of water per tree under their canopies. One week after the spray of sodium hypochlorite, you can apply talc based bioformulation of *Tricoderma asperellum* @ 100g mixed with 2.5g FYM per plant at foot and basin region of the plant to manage this disease.
6. To control Anthracnose and downy mildew diseases of grapes, spray the vines with Bordeaux mixture (2:2:250) in end August using 500 liters of water/acre.
7. Fix PAU fruit fly traps @ 16/acre in citrus orchards in the second week of August and recharge the same if required.
8. In guava orchards, regularly remove and burry the fruit fly infested guava fruits.

ORNAMENTALS

Permanent plants: New plantation of ornamental trees, shrubs and climbers can be continued in this month.

Pot plants: This is ideal time for the potting and repotting, while repotting, the roots of the plants needs to be pruned and the soil mixture is replenished and refilled in this process. Some plants can be multiplied through division during the process of repotting.

Lawns: New Lawn can be planted in this month in already prepared land. Frequent mowing of the lawn is done for ensuring a smooth carpet like effect. Avoid mowing when soil is wet due to rainfall

Chrysanthemum

1. Rooted cuttings planted in pots in the last month should be trained according to their

types viz. standard and spray type.

- The small flowered 'spray' type varieties should be pinched by removing terminal buds.

Roses

Regular weeding of roses should be done and suckers should be periodically removed. Monitor the crop for the attack of red scale.

Trees and shrubs

The shrubs can be propagated from hardwood and semi-hardwood cuttings during this month. Tree seeds can also be sown over nursery beds ensuring appropriate seed treatment.

Marigold

Punjab Gaiinda No.1 marigold can be transplanted in prepared field for seed production purpose.

AGRO FORESTRY

Transplanting of most of the tree species like Safeda, Kikar, Subabul, Tahli, Dek, Neem, Sagwan etc. should be done during July-August (rainy season). The pits of 50×50×50 cm should be filled with 50 percent top soil and 50 percent farm yard manure. Plant the seedlings in the centre of the pit after gently removing the polythene bag. Care should be taken that the earth ball and roots do not get damaged. Apply the light irrigation, immediately.

POPLAR: All the *kharif* crops (except paddy) can be grown in poplar during first two years of tree growth. Afterwards *kharif* fodders such as maize, sorghum, bajra, guinea grass etc. should be grown. The incidence of defoliators and leaf webber is common in this month. Collect the badly infested leaves having eggs and caterpillars of defoliators and leaf webber and bury in the soil. Keep the fields weed free.

BEE KEEPING

Inspect all the honey bee colonies very quickly and if there is scarcity of food reserves in the colonies and also dearth of bee flora in the fields, provide sugar syrup (sugar and water mixed in ratio of 1 : 1) to all the colonies in the late evening. Prefer to provide this feed in Division Board Feeder or directly into empty raised combs. For augmenting brood rearing, the colonies should be fed either stored pollen or PAU pollen substitute/supplement. Take all precautionary measures to avoid robbing and appropriate measures to check it if at all it occurs. Protect the colonies from the attack of wax moths, ants, wasps and green bee-eaters. Take appropriate measures to check wax moth infestation of stored combs as well. Unite weak, queenless and laying worker colonies, if any, with queen-right colonies after the necessary preliminaries. Must keep the colonies on high stands and tilted a little in front to prevent the entry of

rain water into the colonies or its accumulation inside the hive. Hives should not be left in low lying places and ensure their placement at upland to ensure adequate ventilation in order to minimize the impact of high humidity, besides preventing chances of stagnant rain water entering into the colonies. Do not keep colonies in the way of dry water-way/channels. Must use top cover covered with galvanized iron sheet. Remove all the weeds growing underneath and around the colonies. Ensure that aeration facilitating wire gauge of inner cover is clean and should not be clogged with propolis.

MUSHROOM

- For cultivating paddy straw mushroom, the prepared paddy straw bundles should be wetted with fresh water and spawned.
- After one day of spawning, the spawned beds should be watered daily twice a day.
- The mushrooms will start appearing after 12-14 days of spawn run.
- Harvesting of this mushroom will be continued for one month..
- After the completion of crop cycle, discard the old beds and prepare new beds for next crop.
- Harvesting of milky mushroom will be continued during this month.

DAIRY FARMING

- Use of foggers or sprinklers intermittently. Use of only fans should be continued.
- If the animal has a wound, protect it from flies so that maggots do not develop into it. Keep the surroundings clean and preferably apply fly repelling ointment on the wound i.e. Topicure spray or Lorexane. To treat maggot wound, apply negasunt powder first above ointments.
- This month is hot, humid during which flies, lice and ticks are very common. These suck blood, cause skin irritation and spread diseases. To check these, spray Butox/cleaner/amitraz 2 ml/liter water on the animals and use Kohrsolin 10 ml in 1 liter water on the animals during early hours of the day as well as on the sheds and repeat the spray after 10-15 days. Do not spray animals below 6 months of age. Animals sheds especially corners, crevices etc. should also be sprayed. Take full care that insecticides do not get mixed with feed, fodder and drinking water. Strictly follow the manufacturer's instructions while spraying the insecticide. Also deworm the animals with broad spectrum anthelmintics like albendazole and levamisole. Use fendendazole in advance pregnancy.
- During this period there is scarcity of green fodder. Use silage or sugar beet pulp alongwith wheat straw. Progressive farmers are already

using silage throughout the year. Provide concentrates during cooler hours of the day.

- Frequent feeding should be done by giving 4-5 small meals.
- Provide atleast 30-35 Kg green fodder mixed with 1 to 1½ Kg wheat straw alongwith 50 gm common salt and 50-100 gm soda bicarb according to yield of animal, to avoid acidosis in lactating animals Provide 1 kg concentrate feed for every 2.5 Kg milk produced by cow and 2 Kg milk by buffalo.
- Observe color of urine. If pale yellow, means animal is taking less water. Provide water adlib.if animal consuming less water do top dressing with 50-70 gram common salt.
- Keep checking mucus membranes in mouth, conjunctiva of eye and vaginal mucosa for paleness to ascertain anemia and tick born diseases alongwith rectal temperature. If temperature is above 102°F then take advice of a veterinarian.

POULTRY FARMING

- The ration should contain 15-20 % protein, minerals and vitamins (ascorbic acid) as feed intake in summer is reduced.
- Damp litter and high temperature are good media for the growth of protozoa which cause *Coccidiosis* in the chicken so avoid dampness in the deep litter house by stirring the litter 2-3 times in a week.
- Place the nests inside the sheds, 1-2 weeks prior to the start of egg production.
- Feeding should be done during cooler parts of the day by restricting feed during afternoon hours from 11:00 AM to 3:00 PM to reduce heat stress.
- Keep sufficient cold water available for the birds all the time. Add electrolytes in drinking water 5gm/liter of water per 100 birds or 40-50 gm vitamin C per quintal of feed.
- The temperature of the poultry house should not be more than 26°C. Be careful about the health of the birds. Immediately consult the expert in case of sickness of the birds.
- Do not store the compound feed for more than 15 days to avoid aflatoxins.
- Control the flies in the shed especially in cage house.
- Debeaking and vaccination may be done up to 14-16 weeks of age. The price of eggs start rising from this month so there should be minimum disturbance after laying starts.

Compiled by: Amarjit Singh

Information supplied by: P.K. Chhuneja, K.S. Suri, Amit Kaul, Arsh Alam Singh Gill, Jaswinder Singh Brar, Navneet Kaur, Simrat Singh, Ruma Devi, Tejbveer Singh and Shivani Sharma.

Training Programmes in August

-**KVK, AMRITSAR. (98723-54170)**.....
- August 01-09** : Mushroom cultivation as subsidiary occupation
- August 02** : Production technologies of winter vegetable crops
- August 03-04** : Anemia management through iron rich recipes
- August 16-24** : Preparation of eco-friendly cleaning agents
- August 17** : Feeding and management of poultry birds
- August 21-29** : Goat farming
- August 22-23** : Nutritional security through Integrated Nutrition Garden
-**KVK, BATHINDA. (0164-2215619)**.....
- August 01-02** : Dietary management for lifestyle diseases
- August 02** : Production technologies of root and leafy vegetable crops
- August 03-11** : Poultry farming
- August 11** : Integrated Weed Management in rabi crops
- August 14** : Improved cultivation techniques of kharif crops
- August 16** : Feeding and management of poultry birds
- August 17** : Organic farming of vegetables
- August 18** : Market led extension for rabi crops
- August 24-25** : Dietary management of anemia
-**KVK, FARIDKOT. (01639-253142)**.....
- August 01** : Preventive/post-accident guidelines in agriculture
- August 03** : Production technology of root and leafy vegetable crops
- August 07-11** : Construction of biogas plant
- August 11** : Cultivation of sugarcane
- August 17** : Organic farming of vegetables
- August 21-25** : Embellishment of clothes using modern and traditional techniques in dyeing
- August 25** : Feeding and management of poultry birds
-**KVK, FATEHGARH. SAHIB. (01763-221217)**.....
- August 07-11** : Nursery production of horticultural crops
- August 08** : Feeding and management of backyard poultry farming
- August 09** : Integrated Pest Management in kharif crops
- August 10** : Production technologies of root crops and leafy vegetables
- August 16** : Planning and infrastructure for cultivation of mushrooms
- August 18-28** : Dairy farming
- August 21-25** : Nursery production of horticultural crops
- August 22** : Nutritious recipes for young children and pregnant/lactating mothers
- August 30** : Soilless model for vegetable kitchen garden
- August 31** : Efficient use of crop residue machinery
-**KVK, FEROZEPUR. (MALLEWAL). (01632-279517)**.....
- August 02** : Integrated Pest and Diseases Management of kharif crops
- August 03-11** : Poultry farming
- August 04** : Custom hiring of agricultural machinery
- August 08** : Value addition of canola sarson
- August 07-16** : Mushroom cultivation and processing
- August 18** : Feeding and management of poultry birds
- August 22** : Balanced diet for different age groups
- August 25** : Training on soilless vegetable cultivation
-**KVK, GURDASPUR. (01874-220743)**.....
- August 04** : Mushroom cultivation
- August 07-11** : Pig farming
- August 16** : Pesticide residue free basmati cultivation
- August 17** : Green fodder production round the year
- August 21-25** : Mushroom cultivation
- August 23** : Identification of major insect-pests and their damaging symptoms
-**KVK, HOSHIARPUR. (BAHOWAL). (98157-51900)**.....
- August 09** : Feeding management of poultry birds
- August 10** : Production technologies of root and leafy vegetables
- August 18** : Safe and judicious use of pesticides
- August 21-25** : Goat farming
- August 24** : Garment embellishment through different techniques
-**KVK, JALANDHAR. (NURMAHAL). (01826-292053)**.....
- August 03** : Balanced diet for health management
- August 04** : Safe and judicious use of pesticides
- August 09** : Integrated Farming System
- August 10** : Insect-pest and Disease Management in kharif crops
- August 11** : Protected cultivation and nursery raising techniques of vegetable crops
- August 14** : Preventive/post-accident guidelines in agricultural machinery operations
- August 16-23** : Awareness about immunity boosting foods
- August 17** : Cultivation of garlic
- August 18** : Cultivation of pesticide residue free basmati
- August 21-25** : Protected cultivation and nursery production in horticultural crops
- August 23** : Happy Seeder technology for crop residue management
- August 28** : Feed formulation for different categories of pigs
-**KVK, KAPURTHALA. (01822-233056)**.....
- August 04** : Nutritious recipes for young children and pregnant/lactating women
- August 11** : Awareness about immunity boosting foods
- August 17** : Integrated Pest Management in kharif crops
- August 22** : Soilless model for vegetable kitchen garden
- August 23-29** : Nursery production in horticultural crops
- August 24** : Efficient use of crop residue machinery
-**KVK, LUDHIANA. (SAMRALA). (01628-261597)**.....
- August 02** : Nutritional recipes for young children and pregnant/lactating women
- August 03** : Low cost nutritious recipes using underutilized vegetables
- August 07-11** : Preparation of bakery and confectionary products
- August 08** : Dietary management of anemia
- August 10** : Green fodder production round the year
- August 21-25** : Vermicomposting
- August 25** : Preventive/post-accident guidelines in agricultural

- operations
-**KVK, MANSA(01652-280843)**.....
- August 04** : Communication skills for transfer of technology
- August 07-11** : Establishment of agro-processing complexes and gur/shakkar making units for enhancing farmers' income
- August 09** : Goat farming – A subsidiary occupation
- August 10** : Dietary management of anemia
- August 11** : Formation of farmer groups/FPOs/CIGs
- August 17** : New cultivation technologies of vegetable crops
- August 21-25** : Nursery production in horticultural crops
- August 23** : Small scale agro-industry – A way to become an entrepreneur
- August 24** : Identification of parasitoids and predators of major crops
- August 25** : Recommended practices for clean milk production
-**KVK, MOGA (BUDH.SINGH.WALA). (81465-00942)**.....
- August 04** : Dietary management of anemia
- August 07-11** : Establishment of agro-processing units
- August 10** : Feeding and management of poultry birds
- August 11** : Green fodder production round the year
- August 14-21** : Preparation of eco-friendly cleaning agents
- August 21** : Production technologies of root and leafy vegetable crops
- August 21-25** : Goat farming
-**KVK, PATHANKOT. (98762-95717)**.....
- August 04** : Preparation of balanced ration for the goats
- August 07-11** : Pig farming
- August 08** : Dietary management of lifestyle diseases
- August 09** : Seed processing and storage of kharif season crops
- August 17** : Production technologies of root and leafy vegetable crops
- August 18** : Personal hygiene and nutrition for adolescent girls
- August 21-25** : Mushroom cultivation and processing
- August 22** : Efficient use of crop residue management machinery
- August 30** : Efficient use of crop residue machinery
-**KVK, PATIALA (RAUNI). (94642-10460)**.....
- August 01-10** : Entrepreneurship development programme in dairy farming
- August 04** : Custom hiring of agricultural machinery for income enhancement
- August 10** : Seed production of onion and cultivation of winter vegetables
- August 11** : Value addition of soybean and milk
- August 16-22** : Entrepreneurship development programme in mushroom cultivation
- August 17** : Vermicompost production
- August 18** : Sensitization regarding reproductive health issues and safe motherhood
-**KVK, ROPAR. (01881-220460)**.....
- August 10** : Proper spray techniques for management of brown plant hopper in rice
- August 11-18** : Preparation of eco-friendly cleaning agents
- August 16** : Production technologies of root and leafy vegetable crops
- August 21** : Organic farming of vegetables
- August 22** : Nutritious recipes for pregnant and lactating women
- August 23** : Soilless model for vegetable kitchen garden
- August 24** : Clean milk production and its processing
- August 25** : Low cost nutritious recipes
-**KVK, SANGRUR. (KHERI). (01672-245320)**.....
- August 07-11** : Nursery production in horticultural crops
- August 08** : Judicious use of pesticides in kharif crops
- August 11** : Production technologies of root and leafy vegetable crops
- August 16** : Custom hiring of agricultural machinery
- August 17** : Rice residue management technologies for improving soil health
- August 21-25** : Mushroom cultivation as subsidiary occupation
-**KVK, SHAHEED.BHAGAT.SINGH.NAGAR**.....
-**(LANGROYA). (01823-250652)**.....
- August 01** : Safe use and handling of spraying equipments and farm machinery
- August 02** : Nutritional security through Integrated Nutrition Garden
- August 03** : Safe and judicious use of pesticides
- August 04** : Nutritious recipes for young children and pregnant/ lactating women
- August 14** : Production technologies of root and leafy vegetable crops
- August 17** : Establishment of nutrition garden in urban and peri-urban areas
- August 18** : Management of insect-pests and diseases of major crops
- August 21-25** : Poultry farming
- August 28** : Integrated Pest and Disease Management in kharif pulses
-**KVK, SRI.MUKTSAR.SAHIB. (GONEANA)**.....
-**(94630-22203)**.....
- August 03** : Feeding and management of poultry birds
- August 04** : Importance of millets in balanced diet
- August 07-11** : Preparation of millet based recipes (dalia, khichri, poha,prantha, etc.)
- August 10** : Improved cultivation practices of carrot production
- August 21-31** : Value addition to household articles through traditional embroidery Phulkari, painting and block printing
- August 22** : Safe and judicious use of pesticides
- August 23-31** : Poultry farming
- August 24** : Safe use and handling of spraying equipments and farm machinery
- August 25** : Processing of milk at domestic level
- August 30** : Efficient use of crop residue machinery
-**SKILL.DEVELOPMENT.CENTRE**.....
-**(0161-2401960.EXT.261)**.....
- August 01- Oct 31** : Integrated crop production training course (129th batch)
- August 07-11** : Organic Farming (vermi-compost and use of biofertilizers for enhancing crop yield and soil fertility)
- August 22-23** : Nursery growing techniques for flower crops
- August 29-30** : Hybrid seed production of maize and sunflower

Compiled by: Dr Inderpreet Kaur Boparai

Dr Balwant Singh Hunjan, Internationally Renowned (Ortho.) Surgeon, Director & Senior Consultant of Hunjan Hospital –Felicitated by Hon. Governor of Punjab and Union Minister (Govt. of India)

Hunjan Hospital (Ludhiana) is International Branded hospital in Robotic Joint Replacement, equipped with state-of-the-Art world class infrastructure i.e. MAKO ROBOTIC ARM Assisted Technology first time in northern India. Dr Balwant Singh Hunjan MBBS, MS, MCh (Ortho) has been honoured by Union Minister (Govt. of India) Sh. Gajendra Singh Shekhawat and Hon'ble Gov. of Punjab Sh. Banwari Lal Purohit, in a special function organized by Eminent Industrial Group, Medical Fraternity and educationist etc. Dr Hunjan was felicitated for the overall distinguished services in medical health care, latest infrastructure,

WORLD'S LATEST TECHNOLOGY FIRST TIME IN NORTH INDIA AT AFFORDABLE PRICES



Punjab Governor H.E. Shri Banwarilal Purohit & Union Minister Sh. Gajendra Singh Shekhawat felicitated Dr. B.S. Hunjan, MBBS, MS, Mch (Ortho) Director & Senior Consultant Orthopedics-Hunjan Hospital, Ludhiana for his distinguished services in healthcare

Deluxe Rooms, Drug Centre, Canteen facility and 24 hrs Emergency Services etc.

Dr BS Hunjan also have the honor to attain international fellowship about 35 advanced countries of the reputed hospitals of the world i.e USA, UK, Australia, Japan, Switzerland, SA, Singapore, China etc. and has performed surgeries with these Eminent and World Renowned Doctors of the Globe. Dr BS Hunjan has performed about more than one Lakh different kind of surgeries during the inception of this hospital.



Dr. Jaiveer S. Hunjan
MBBS, MS (Ortho)

advance Robotic technology in Joint replacement at Hunjan Hospital. Dr BS Hunjan is the only Doctor from Medical

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