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Management of Insect-Pests and Diseases of Pearl Millet

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Introduction

The Government of India has set a target to double the income of Indian farmers by 2022. In this regard, one of the major factors to enhance the income of farmers is timely application of integrated insect-pests and diseases management techniques, because well-timed management practices will certainly lead to good crop health and yield. Among major factors for declining in productivity in rain fed cultivation of crops is the lack of scientific cultivation of crops by the majority of farmers and un-timely management of various pests and diseases. Similarly, reduction in the yield and quality of millet due to the outbreak of pests and diseases, the farmers get a lesser amount of income in comparison to cost of cultivation. Therefore, farmers are advised to manage the pests and diseases in the crop at appropriate time.

Bajra (pearl millet) is the main cereal crop in arid regions, which is grown in large areas which facing adverse conditions like low or limited rainfall without or with very little amount of fertilizers. Although, it is drought tolerant and short duration (80-110 days) crop which can grow in almost all types of soils and conditions. It is grown annually in about 51 lakh hectare area of Rajasthan. Bajra is grown in rain fed and irrigated areas in kharif/mansoon season. Along with grain, it also gives good yield of fodder for animals.

Bajra is also an important crop from nutritional point of view. It contains about 15.6% protein, 5% fat and 67% carbohydrate. In western part of Rajasthan, Bajra is grown in an area of 23 lakh hectares but its average yield is very low. By using the following advanced techniques, good yield can be obtained from the millet crop. It is necessary to protect this crop from diseases and major pests. In the initial stage of millet, there is a possibility of getting white grub, termite, hairy caterpillar and stem borer; hence it is necessary to control them timely. Farmers should also prepare the field properly; select improved varieties, adopt timely sowing and apply balanced dose of manure and fertilizers as well as control of pests and diseases for best yield of millet. These practices not only affect the production of the crop

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but also affect the productivity. Following are the some important insect-pests and diseases of the crop that should always be in mind to follow them.

Major insect-pests of millet and their control

White grub:

This insect is active from July to November. Both its beetles and larvae damage the plant. Its beetles (adults) are brown and light-brown in color, which emerge from the ground only after the first monsoon rains when it is dark in the evening and gather on the nearby plants and destroy the plant's leaves. And before morning they go back into the ground. Its larva is in the shape of the English letter 'C', whose mouth is brown in color, which eats the roots of the plants, plants turn yellow and dry up slowly and are easily uprooted on drying. Due to its excessive infestation, the plants are completely destroyed. Therefore it is necessary to control it in time.


Beetle (Adult)


Grub

Beetle (adult) Control: Place light traps @ 1 trap/ha in night after receipt of first monsoon rains.Trim off trees and shrubs in and around the fields. Spray insecticides such as imidacloprid 17.8SL @ 0.5 ml/litre or monocrotophos 36SL @ 1.6 ml/litre during the evening hours on trees and shrubs. Place 3 pheromone (synthetic pheromone-Anisole) dispensers per tree at 15 meter radius for three consecutive evenings after the first monsoon rains.Collect and destroy the adults fallen near the base of trees by putting them in kerosene solution.

Grub (Larva) Control: Follow deep summer ploughing to expose the pupae to scorching sun radiation and predation by birds.Use well decomposed organic manures. Adopt crop rotation with jowar/sorghum and bajra/pearl millet. Incorporate carbofuran 3G @ 33.0 kg/ha or phorate 10G @ 25.0 kg/ha in soil before sowing. Seed treatment with chlorpyriphos 20EC @ 6.5-12.0 ml/kg or imidacloprid 17.8SL @ 2.0 ml/kg seed. Take up early sowing if

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irrigation facility available. Drench the root zone of crop with chlorpyriphos 20 EC @ 4.0 lit./ha or quinalphos 25EC @ 3.2 lit./ha three weeks after the adult emergence.

Termites:

Termites are omnivorous pests that cause economic loss in fields as well as in storage/ homes. Termites are pale yellow or brown in color. Its attack starts with the growth of plants, when the plants are small and tender, then it enters their ground surface. They damage both the seeds and the roots of plants by making tunnels. Cut the roots of the plants from the bottom and plants dry, apart from this they also destroy the crop by eating the stem of the plants. Termites cause more damage at night and its outbreak is more in un-irrigated or in low moisture areas.

Termite

Control: - For its prevention, do deep plowing in the field in the month of April-May and destroy crop residues and weeds. Do not use un-rotten FYM, as the risk of termites is more in raw dung. Before sowing, add 30 kg of neem cake per acre of field. Apart from this, 2 kg of dry neem seed powder can also be mixed per acre of field. Treat the seeds with imidacloprid 17.8 SL @ 3 ml/kg seed. In standing crop, apply imidacloprid 17.8 SL or fipronil 5% SC with irrigated water in irrigation.

Hairy caterpillar (*Katra*):-

There are two species of *Katra*, namely Bihar Hairy Caterpillar and Red Hairy Caterpillar. The red-brown hairy larvae of second species, red hairy caterpillar, is known as *Katra*. The outbreak of this pest starts immediately after the monsoon rains and lasts up to October. As soon as it rains, the caterpillar moths come out of the ground, from its eggs, small larvae come out, which grow up to eat the soft stem and lower surface of the millet crop and damage the crop. Moist environment is a favorable condition for its growth. If moths are controlled in time, damage can be avoided.

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Red Hairy Caterpillar (*Katra*)

Control: - Stopping the movement of caterpillars in the fields is an effective measure of prevention. For this, after harvesting the kharif crops, deep plow the fields, due to which larvae are destroyed by birds and other reasons. When there is an outbreak of this insect, it is possible to reduce the population by the use of light sources to attract the moths towards light through gas *lalten* or electric bulb on the bunds of the field. Put a bucket or tub below the light source with oil and water, so that the moths attracted to the light fall into the water and get destroyed. Another way to kill caterpillars, dig out a trench about 1 feet deep, add quinalphos 2% powder at the rate of 25 kg per hectare. By burning of grasses and garbage in the field, moths can be destroyed. Plug the leaves along with the caterpillars and burry such leaves deep in the soil or kill them by dipping in kerosene solution. Among chemical control, spray indoxacarb 14.5 SC @ 0.5 ml per liter or emamectin benzoate 5% SG @ 0.4 g per liter of water.

Cut worm (*Bhundi*) :- It is gray in color that causes damage from August to October.

Control: - Spray malathion 50 EC @ 400 ml in 250 liters of water per acre.

Major diseases of millet:

Green ear or downy mildew disease (*Jogia rog*) :-

The symptoms of this disease usually appear on the leaves after 25 to 35 days of sowing and in some places after one to one and a half months. To diagnose the disease, the leaves of millet should be looked upside down, white powder is deposited on the lower surface of the leaves and the leaves turn yellow. Yellowing, dwarfing and drying of leaves are also important symptoms of the disease. The flowers of crop are converted into leaf like structures, known as "green ear". There are no grains into the diseased ears. Severe infestation can completely destroy the crop.

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Green ear disease (Jogia)

Ergot disease (*Gundia or Chepa*):-

The outbreak of this fungal disease is more at the time of flowering. A thick and sticky liquid of light pink color comes out from the flowers of the affected ears, which later turns dark brown and on drying, a hard layer becomes on the ears. The diseased ears do not develop grains and after a few days dark brown sclerotia are formed in place of the grains. Sclerotia are larger than seed and irregularly shaped, and generally get mixed with the grain during threshing. A toxic substance called argotin is found in the infected ears, which is harmful (poisonous) to humans and animals and causes disease.

Ergot of Bajra

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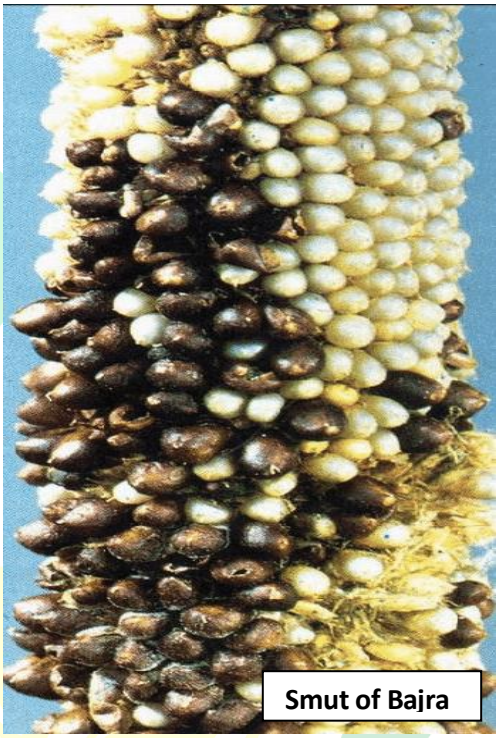
Smut disease (*Kandua or Kangyari*):-

The outbreak of this disease usually occurs on the crops at the flowering stage. At initial stage, diseased sori are formed, which are dark green, shiny and large in size, later on become brown in color and filled with black powdery spore masses.



Smut of Bajra

Blast disease:

Blast disease caused by fungus and affect aerial (leaf, stem and ear) parts of crop. The initial symptoms of this disease appear on leaves 20 to 25 days after transplanting or sowing. In the initial stage, small boat shaped light brown or purple color spots are appeared on the lower leaves, which gradually become broad in the middle and narrow at the edges like eyes with gray centre. Infected plants become weak and produce less ears. The grains do not fill completely and the yield is reduced.

Blast of Bajra

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Integrated disease management:

Cultural practices: These are the traditional methods of disease management. Sow crop on time, use recommended seed rate, follow crop rotation with non-host crops and apply balanced dose of fertilizers with efficient weed control.

Use of resistant varieties: The use of disease resistant varieties is the cheapest and most durable method of disease control. So, grow disease resistant varieties.

Seed selection and seed treatment: Inspect the seeds thoroughly and observe that there are no ergot (Chepa) sclerotia. If, the seeds are not taken from certified agency, then farmers are advised to treat the seeds in brine/salt solution. In this method, dip the seeds in 10% salt solution and stir for 10 minutes and remove the floating materials and wash them thoroughly with clean water. If any trace of salt remains on the surface of the seed, it affects the germination of the seed. Finally, dry the seeds in the shade and before sowing such seeds, treated with agrosan GN @ 2.0-2.5 g or thiram @ 3.0-3.5 g per kg seeds. For downy mildew (green ear disease), the seed should be treated with metalaxyl @ 6 g per kg of seed.

Removal of diseased plants: As soon as the symptoms of green ear disease appeared on the leaves of the millet crop, uproot them and destroy and the uprooted diseased plants should not be in contact with healthy plants. In susceptible varieties of millet, after removal of diseased plants, spray the crop with zineb or mancozeb 0.25 % solution.

Chemical methods: This is the most effective and easiest method of disease management, but excessive use of chemical pesticides in integrated disease management is not appropriate for the crop and soil, because these chemicals increase the resistance in pathogens to chemicals and along with decrease soil quality. There is also a harmful effect on crops and beneficial microorganisms. Always use appropriate amount of insecticides, fungicides, bactericides, insecticides and weedicides for seed, soil treatment and foliar spraying. By adopting Integrated Pest and Disease Management (IPM) with bio-control agents, the amount of chemical pesticides can be reduced and the environment can be saved.

Green ear disease(Downy mildew): Seed treatment with metalaxyl @ 6 g per kg of seed. In the standing crop, spray mancozeb@ 0.25% at first appearance of the disease.

Ergot disease (Gundia or Chepa): Spray mancozeb @ 0.25% at the time of flowering.

Smut disease: Before sowing, sow the seeds by treating them with Carbendazim @ 2-3 gm per kg of seed and spraying with Mancozeb@ 0.2%.

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Blast disease: Before sowing, treat the seeds with carbendazim @ 2g per kg seed and at appearance of symptoms, spray carbendazim +manconzeb @0.2%.

Bio-control agents: Under this component, management of diseases is done by biological methods like microbial protection (Fungus-*Trichoderma* spp. and bacterium-*Pseudomonas* spp.) by seed treatment, soil treatment and foliar sprays. Bio-fungicide (*Trichoderma* should be used @ 4 g/kg seed for seed treatment. For soil treatment, apply *Trichoderma* 2.5 kg/ha mixed with 100 kg FYM in soil.

Key points to follow during cultivation:

1. Destroy affected ears of ergot (*Chepa*). Do not use ergot affected ears for feeding to animals.
2. Adopt long crop rotation of 3 to 4 years with non-host crops in disease prone areas.
3. After harvesting, always follow deep plowing, so that ergot sclerotia, downy mildew spores etc. are destroyed in the soil.
4. Remove the sclerotia of ergot from the grain.
5. Do not allow vine weeds and grasses to grow around the bunds of the field.
6. Always keep watching the changes in the crop and if there is immediate requirement of any pesticide apply promptly with correct dose.