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AGRO-ECOSYSTEM ANALYSIS (AESAs): A SUSTAINABLE APPROACH FOR CROP PEST MANAGEMENT

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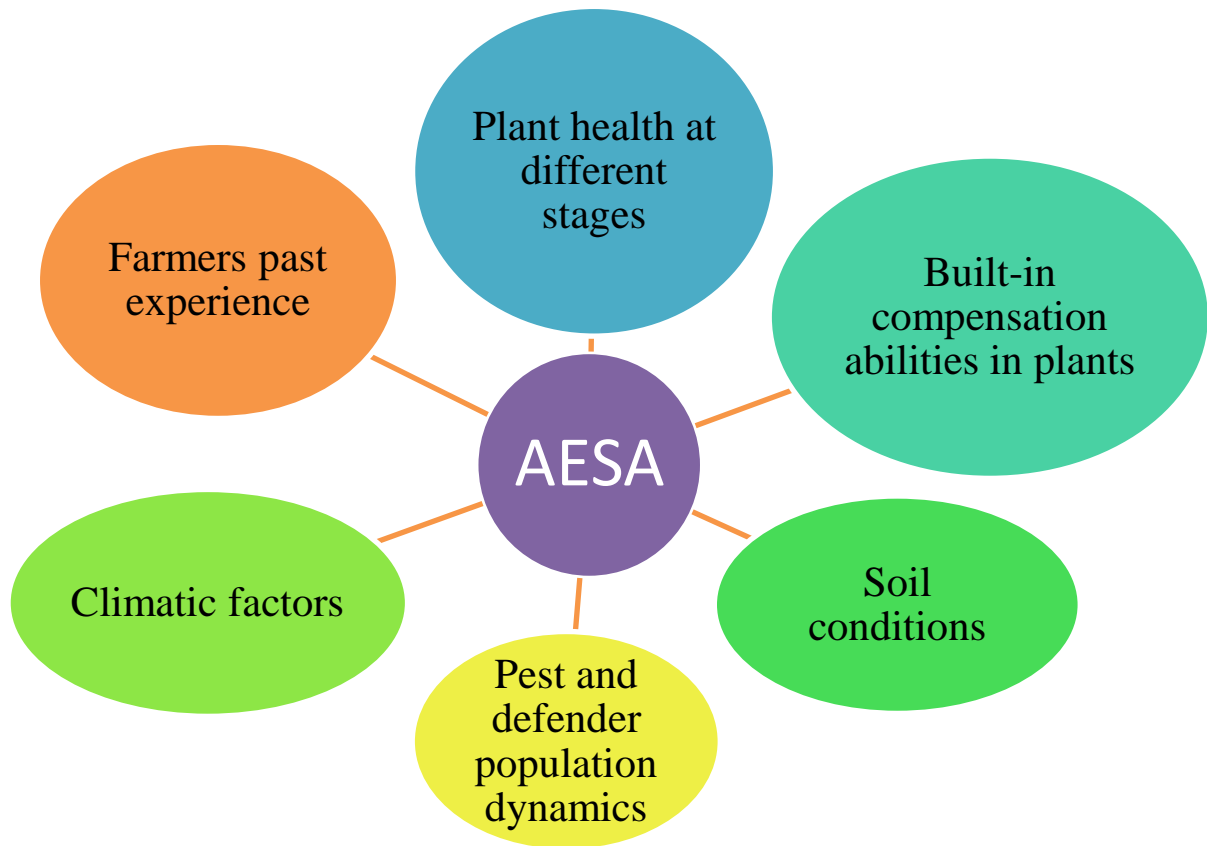
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As the population is increasing at a rapid rate, the demand for food is at high. This forces the grower to depend more on inorganic pesticides to instantly control the pest. But due to over-use of these poisons, the natural enemies present in the field are getting hampered. Even the problem of bioaccumulation and bio magnification of toxicants is becoming common. So to provide a sustainable solution to these alarming problems AESA is being introduced. The health of a plant is influenced by its abiotic and biotic environment. There should be a proper balance between these two for proper functioning of the ecosystem. The population of biotic factors (insect pest, diseases and weeds) depends on the abiotic factors (Weather conditions). Hence having a good knowledge regarding both of these factors is very important for the farmer. Agro-ecosystem analysis (AESAs) based IPM is an innovative method where the farmers or the extension workers examine the crop field conditions with respect to prevalent pests, plant pathogens, beneficial insects, plant health and the influence of climatic factors and their relationship for cultivating a healthy crop. In AESA, the farmer first observes his field minutely and then analyses the present condition which led to take proper decision.

Components of AESA

The various components of AESA include:



Principles of AESA

1) Healthy Crop

The basic principle of AESA is production of healthy crop. For achieving this principle, the grower need to use good quality certified seeds and planting materials brought from some authentic sources. They should better cultivate the pest resistant or tolerant varieties. The next step is seed treatment with recommended pesticide especially bio pesticides. The crops should be shown in proper spacing for preventing the building up of congenial environment for pest outbreak. The health of the soil should be looked upon by growing green manure crops and mulching. Nutrient management should be done based on the soil test data. Integrated approach of nutrient management should be taken to reduce the application of inorganic fertilizers and increase the use of manures and bio fertilizers which are not only good for plant but also beneficial to soil microbial biota. Application rate of nitrogenous fertilizers should be checked as excess nitrogen increases the succulence of crop and make it susceptible for pest attack. Potassium must be added as it makes the crop resistance to pest and diseases. Proper weed management should be followed to keep the weeds below ETL.

2) Monitoring of Field

Monitoring of the crop field is an important job of the farmers to go for preventive measures as compared to prescriptive ones. The grower should observe the field conditions properly at least once in seven days to keep good knowledge about the conditions of the soil, plant, water, climate and pest and beneficial insect of his farm. The farmer is advised to take decision based on his present condition of field and after calculating the pest: defender ratio. The farmer should always try to take some preventive control to keep his field out of the attack of pest and take necessary integrated measures on need.

3) Calculating the Plant's Compensation Ability

Compensation ability refers to the regrowth of the plant biomass which was eaten away by herbivores (insects, cattle, goat, etc.). The compensation ability depends upon the photosynthetic rate of the plant and its source: sink ratio i.e. mobilization of stored foods from roots and remaining leaf to newly formed leaves. Healthier the plant better is the mobilization. Interaction of plant traits and external environmental factor leads to plant tolerance to herbivores.

4) Conservation of Natural Enemies

Defenders or the natural enemies (viz. predators, parasitoids) are very important components of bio control of pest. The farmer needs to know the natural enemies present in his field and should regularly monitor their population dynamics. The broad-spectrum pesticide apart from killing the target pest kills the natural enemies too. So farmer should avoid such pesticides.

5) Insect Zoo

Insect zoo is method by virtue of which a farmer can easily differentiate between harmful and beneficial insect. Diverse group of insects are present in field. Out of them some are beneficial and referred as farmer's friend and rest cause economic loss to crop hence are pests. Bio agents like predators are difficult to observe in field as they often resemble the pests. In the method of insect zoo, the unknown predators are collected from field and taken to lab for observing the details. Each predator is then kept in a plastic bottle with some plant parts and some insect pests. If the predator (assumed) is seen to feed on the other insect, it is

declared as predator or else if it feeds on plant parts it is declared as crop pest. By using this method farmer identifies the beneficial insect and conserves its population in field.

6) Calculating the Pest: Defender Ratio (P:D ratio)

The Pest:Defender ratio is very important for the farmer to have an idea regarding the population dynamics of pest and beneficial insects (predators). Visual monitoring or using of sweep nets may be done to calculate the P: D ratio. The P: D ratio depends on the type of pest and the potentiality of the predators to feed on the pest. It varies from crop to crop. Generally when the value of P: D ratio is 2:1, management should be adopted.

A Prominent Example of AESA

Suppose a farmer is going for the management of yellow stem borer in his rice field. The first step involves a through observation of the field conditions. The weather conditions (temperature, RH, rainfall) should be considered because the multiplication and spread of pests depends upon weather factors. Then the farmer should calculate the Pest:Defender ratio of his field. The Predator:YSB ratio of different predators are Mirid bug (3:1), Preying mantid (4:1), Long horned grasshopper (3:1), Carabid beetle (5:1) , Lynx spider (2:1). If this ratio changes, the farmer should go for spraying insecticide for YSB management.

AESA vs. ETL

While initiating a pest management program based on economic threshold level (ETL), the farmers mainly focuses on the population dynamics of pest which is observed by pest counts. While the important parameters like the presence of defenders, prevailing weather conditions, stage of growth of the crop are not taken into account. Hence in true sense, pest management based only on ETL is not very prominent one as the ETL keeps on changing and moreover damage caused by certain insects cannot be predicted at all. Whereas on the other hand, AESA based pest management give importance to defenders, plant compensation ability, P: D ratio etc., which makes it more precise over ETL.

Benefits of AESA

- By practicing AESA, the farmers develop their expertise in crop management.
- Farmers identify the major and minor pests of the crop and their nature of damage.
- Beside pests the farmer become aware of the natural enemies or the defenders present in his field and learns about their role in pest control.

- Farmers also gain knowledge regarding the influence of weather parameters on pest multiplication.
- The farmer becomes expert in taking proper decisions at proper time to prevent economic loss and enjoy good profit.

Conclusion

AESA is a planning tool and a practical guide which gives farmers a good overview of their field and thus helps him to take proper management at the right time. Decision making in pest management requires a thorough analysis of the ecosystem. By doing so the farmers can prevent his crops from the attack of the pest and can reduce the over use of chemical inorganic pesticide beside exploit the beneficial insects to control the pest by means of a economically and ecologically sound manner.

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