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Cultural Practices: An Urgent Need in IPM for Sustainable Crop Production

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ARTICLE ID: 13

Abstract:

Cultural practices is perhaps as old agriculture, though it may not give spectacular and immediate result but at first line of defence as modification of certain farm operations make the environment unfavourable for insect multiplication. Modification of planting/ sowing, growing, cultivating, harvesting, plant placing, cropping system, water and fertilizer management techniques prevent build-up of certain paste population. Ploughing and digging of field stubble reduce the number of larva and pupa of many insect pests. On other hand keeping plots flooded or saturated by water favoured build-up of root feeding midge and yellow stem borer. Thus, sound knowledge of pest biology and plant is needed before any techniques are introduced, as pest status may alter with these modifications. Cultural practices have dual purpose, crop production and will as pest management, however, hence we discussed the validity of techniques and their importance only in relation to pest management. Although before adopting such component one should be sure that it will be compatible with other measures as well as crop and must be economical for readily adoption by farmers community. Cultural control measures have many components which are discussed and concluded in this manuscript.

Keywords: crops, cultural practices, management.

Introduction:

Cultural practices operations of all the crop production and management techniques which are utilized by the farmers to maximize their crop productivity and farm income. these practices include decisions on crops to be grown, time and manner of planting, tillage, field and crops sanitation, application of fertilizers and irrigation, harvesting times and procedures and even off season operations in cropped fields.

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The manipulation of these practices for minimizing or avoiding pest damage to crops is known as cultural control measure. Since cultural control practices manipulations are based on habitat management and require a thousand understanding of different components of the agro ecosystem in which pest thrive, this approach has also been called as ecological management or environmental control. The purpose of cultural control practice is to make the environment less favourable for the insect pest and more favourable for their natural enemies. today's, this practice is also a major component of natural farming system approach.

Components of cultural practices and their management strategies:

1. Tillage:

The type and timing of tillage can markedly influence the soil environment and affect the survival of insect pest and their natural enemies. Ploughing is often helpful in reducing the overwintering population of *Helicoverpa spp*. and the several species of cutworms that undergo diapause in the soil during winter season. Deep ploughing immediately after harvest of wheat crop in April-May is helpful in exposing the resting grubs of rice root weevil to their natural enemies like birds and to the action of Sun and wind. deep ploughing is also helpful in minimizing the infestation of armyworms in cereal crops, white grubs taking in groundnut and chillies caterpillars attacking in groundnuts and chillies, pupae of hairycaterpillars attacking green gram, groundnut, maize etc. Raking up and hoing of the soil around melon plants, mango and other fruit trees serve to destroy pupae of fruit flies. A disc plough treatment cause up to 73% mortality of overwintering in larva of *Dictus tixanas*, a pest of sunflower compared to 40% mortality recorded using a country plough. Light earthing at early stage of sugarcane crop during May -June is helpful in minimizing the shoot borer incidence.

2. Planting time:

The manipulation of planting time helps to minimise pest damage by producing synchrony between host plants and the pest or synchronising insect pest with their natural enemies. Early planting has been found to reduce gall midge and leaf folder damage in rice, shoot fly and head bugs damage in Sorghum and millets, white grub damage in groundnut and mustard aphid damage in brassica crops. Timely and synchronous planting has been found to reduce bollworm damage in cotton and stem borer in sugarcane. The rarely and late

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sown cotton crops suffered higher damage due to pink and spotted bollworms. (Dhaliwal et al, 1992).

Early sowing can be used to minimize *Helicoverpa armigera* Hubner damage to chickpea in Northern India. Two peaks of *Helicoverpa armigera* occurs during December and March in the rainy season. During the second peak, the pest inflicts severe damage to chickpea crop. early (October) sown crop escapes with least damage late sowing (December and January) matures during late March to April and suffer heavily damage and November sown crop also suffers moderate damage (Rathore and Nwanze, 1993).

3. Plant spacing:

The major objective in spacing of crop plants is to obtain maximum high-quality yield per unit area with per unit time. but spacing may also influence the population and damage of many insect pests by modifying the micro environment of the crop and affecting wealth. closer spacing has been reported to increase the infestation of plant hopper (Brown plant hopper and white backed plant hopper), gall midge and leaf folder in rice crop. on the other hand, closer spacing resulted in lower incidence of green leaf hopper, rice hispa and whorl maggot (Singh and Dhaliwal, 1994). Closer spacing in groundnut lowered the incidence of thrips, jassids and leaf minor and also increased parasitism in the latter. while in cotton it increased the damage by jassid, white fly and bollworms. In soybean, damage by number of insect pest including *spilosoma obliqua* Walker, *Melanagromyza sojai*Zehntner and *bemisia tabaci* was greater in closely planted crops. In sugarcane, closer spacing resulted in higher investigation of shoot, internode and stalk borers. In contrast to all these studies, population of *Aphis craccivora*Koch in chickpea was more in widely spaced crop (60×20 cm) than in closer spacing of 30×90 cm (Dhaliwal and Arora, 1993).

4. Seed rate:

Application of high seed rate is recommended in those crops where removal of infested plants is helpful in minimizing the incidence of insect pest viz, steam borer in maize crops and shoot fly in Sorghum and other crops.

5. Plant Diversity:

Difference of colonization is probably one of the most promising means of minimizing insect pests through intra field diversity, because only a little additional diversity in the crop field May have profound effect on colonization by insects. the diversity of a crop

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system can be increased by intercropping, trap cropping or mixed cropping. (Cromartruie Jr, 1993).

(a) Intercropping:

Intercropping of cotton with black gram, green gram and cowpea are reported to divert the population of sucking pest (jassid and whiteflies) and American bollworm from cotton. Monoculture of cotton was also found to harbour Mall insect pest than cotton inter cropped with cowpea, soybean and groundnut. The intercrop of cowpea in cotton helped in the colonization of Coccinellids and also economical the parasitism of spotted bollworm. on the other hand, mung, okra and pigeon pea as intercrop with cotton increased the population build-up of jassid, white fly spotted bollworm and American bollworm (Simwat, 1994).

Intercropping of groundnut with pearl millet reduced the incidence of thrips, jassids and leaf minor whereas the same with sunflower and caster increase the infestation of Thrips and jassids respectively. when pearl millet was grown as an inter crop in groundnut, the parasitic activity of *Goniozus sp*. was considerably enhanced. The Pollen grains of the millet were preferably and as food by the adult parasitoids.

Tomato intercropped with cabbage has been reported to inhibit/ reduce egg laying by diamond backmoth. A planting pattern of one row of cabbage and one row of tomato (cabbage planted 30 days later than tomato), afforded maximum reduction of diamond backmoth and leaf Webber larva on cabbage. Reduction in insect damage was attributed to possible release of volatile substances from late crop growth stages of tomato which inhibited viposition by incoming moths. run the female moth which entered the mixed crop and laid pleasure eggs probably because of tomato foliage spread over Lori row of cabbage (Srinivasan, 1994).

Sole crop of chickpea attracted more *H. armigera* compared to inter crops with wheat, Barley, linseed, mustard and sunflower. on the other hand, lentil and field peas as intercrops enhanced infestation in chickpea. Crop mixtures were more effective than row planting/sowing (Rathore and Nwanze, 1993).

(b) Trap cropping:

Planting in small areas of a crop or other plants on the borders or even in the main crop mat serve as a trap crop for some insect pest. Even really or late planting of the same crop in the main crop may also serve as traps. The attractiveness of trap crops may be

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enhanced by the use of insect pheromones, kairomones or insect food supplements. Depending on the seasonal cycle insects may be left to develop in the trap or killed with an insecticide.

The major benefit of trap cropping is that insecticides are seldom required to be used on the main crop and this enhance the natural enemies thus, enhance natural control. the overall use of insecticides is clearly less than in conventional farming, making the strategy environmentally attractive.

Trap cropping has been successfully employed on the large scale in four crop ecosystem cotton soybean, potato and cauliflower in USA, Balgenia, Finland and Asian countries. in rice, trap cropping of rice for green leaf hopper Control resulting in 12% higher economic return than chemical control and 19% higher than the untreated control. (Hokkam, 1991).

(c) Crop rotation:

Another way in which crop diversity can be affected is by varying the type of crops growing in adjacent fields. Many insects can move quickly from one field to next and between botanically related crops to obtain their requisites. location of botanically dissimilar crops adjacent to one another will moderate paste movement as insect species would not find requisites in both. large scale monoculture of paddy, cotton, sugarcane and vegetable crops in India has resulted in rapid increase in number and intensity of insect pests. monoculture of cotton continuously over large areas was an important factor contributing of *H. armigera* and white fly outbreaks in South India during the late 1980 century.

(6). Presence of weeds:

Weeds may also adversely affect the orientation of parasites and predators to their prey. the weeds may even directly contribute to pest multiplication by providing preferred surface for oviposition. Vicia sativa is a common weed associated with chickpea in Northern India. removal of the weed at a time when maximum eggs are laid substantially reduces the infestation of *H.armigera* (Rathore and Nwanze.1993).

(7). Crop rotation:

Generally, crop rotation is most effective against insect pest that have a narrow host range and dispersal activity. in Northern India the farmers were generally fallow paddy-wheat crop rotation. the wheat crop serves a host for the survival of a number of insect pest, stem

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borer, pink borer and shoot fly during rabi season. this has resulted in increasing attacks of these pests on both crops. (Nagarajan,1989).

In South India, cotton is grown in 2-3 season throughout the year, thus providing a continuous supply of food for the development and multiplication of pests. cotton should be rotated with non-preferred host like maize, rice, ragi, groundnut, cowpea or soybean to minimize the infestation of insect test (simwat,1994). similarly, rotation of groundnut with non-leguminous crop is recommended as a practice for minimizing the damage by leaf miner.

8. Nutrient management:

In general, irrigation, mulching, manuring and fertilization are practices that promote rapid growth and shorten the time the susceptible stage is available for insect attack, providing the crop with greater tolerance and the opportunity to compensate for insect damage. However, such practices may also change the physiology of host plants, making them less and succulent and thus enhancing pest survival and multiplication.

Excessive use of inorganic nitrogenous fertilizers, generally creates congenial conditions for many insect pests. High level of nitrogen fertilizer significantly increase the infestation of most of the insect pest viz, yellow yellow stem borer, leaf folder, gall midge, green leaf hopper, brown plant hopper, white backed plant hopper, headed bug,hispa,whorl maggot etc on rice crop. In cotton also eat results in greater attack of white fly, leaf folder, and bollworms. In sugarcane, this practice also builds up stalk borer, internode borer and pyrilla population. On the other hand, application of potash and sometimes Phosphorus singly are in combination with nitrogen results in lower infestation of many insectpest on various crops. Potash application enhanced Protein synthesis resulting in reduced amino acid content of the plant sap and thus making the plant less suitable for development and multiplication of sap sucking insects(Bhat, 1979).

Similarly, reduction in the incidence of a number of insect pests viz, *Empoasca kerri* purthi, *Autographa nigrisigna* Walker and *spodoptera litura* fab. On cowpea, green leaf Hopper plant Hopper on rice, aphids and thrips on chillies and Empoasca sp. *Therioaphis trifoli f. maculata* Buckton and *Aphis craccivora* Koch on Lucerne following increase application of potash either singly or in combination with Phosphorus has been reported (Dhaliwal and Arora, 1993).

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In contrast to inorganic fertilizers, organic manures release nitrogen in small quantities over a longer period and hence their application does not generally have to pest outbreak. Special efforts are needed to produce large quantities of organic manures, green manures and bio fertilizers based on rhizobium, Azolla, Azospirillium and Azotobacter can serve as important components of organic manoring. Another alternative involves the use of slow-release nitrogenous fertilizers like Neem cake coated urea and coal tar coated urea. Integrated nutrient management must, therefore, farm and integral part of IPM programs (Jayraj et al,1994).

9. Water management:

The amount of moisture in the soil has a profound effect on the survival of many insect pests. The quality and quantity of nutrients available in the host plants are also greatly affected due to changes in the soil moisture level.

Flooding of field has been recommended for reducing the attack of termite, cutworms, armyworms and white grubs. On the other hand, draining the rice field for 3-4 days during infestation minimized the whorl maggot and brown plant hopper population. Alternate drying and wetting at 10 days intervals starting from 32-35 days after transplanting drastically reduced brown plant hopper and white backed plant Hopper incidence in contrast to continuous standing water. However, the incidence of gall midge was less in continuous flooding (Singh and Dhaliwal, 1994).

Jassids and white flies are especially sensitive to changing water level in their host plants. Maximum fecundity of mustard aphids reared on sarson, ray host plants was recorded when the water level maintained continuously above the field capacity.

Water logging enhance the multiplication of the borer pests and white fly on sugarcane crop. Increase in soil moisture level due to frequent irrigation also helped in build-up of Pyrilla population on this crop, while black bug damage maximum in unirrigated fields.

10. Sanitation:

Clean cultivation as a method for minimizing the infestation of insect pest was advocated more than the century by Balfar in 1887. Destroying or removing crop residues from crop fields is one of the basic ways to eliminate pest overwintering sites and reduce the

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spread of infestation. This may be achieved by ploughing directly or shredding and chopping, burning residues or raking and scooping them into pits for burning.

Sanitation measures have helped to reduce the infestation of leaf hoppers, leaf folder, hispa, gall midge and stem borer on rice crop. Removal and destruction of rice stubbles has been found highly effective in minimizing overwintering population of many species of stem borers. Removal remove of damaged plant parts and uprooting of infested plants including those showing dead marts at thinning time have been recommended to lower stem borer, shoot fly, armyworms, pyrilla, aphids, cutworms and termite incidence in maize crop.

In Sorghum, destruction of alternate host plants helps to reduce incidence of shoot fly, stem borer and head bug. Similarly, removal of host plants of bollworms and white fly. In and around cotton fields has been reported to reduce the incidence of these pests on cotton crop.

Conclusion:

Many of the cultural practices are effective,when undertaken on an locality basis. All formers may adopt a useful cultural practices voluntarily but unfortunately some farmers generally hold out and these practice not becoming popular among the farmers community. Research efforts are needed to sustainable the usefulness of these methods as an economical way of managing insect pests at different stages of crop growth (Rajak, 1992). Many of the traditional cultural practices may not be useful under modern and intensive agriculture. Therefore, sustained research is needed to develop improved cultural control measures which have great potential for use in sustainable agro ecosystems. Modern cultural practices can help to lower the general equilibrium position of many insects' pests of various crops and thus save the environment and health of human being also increased crop production and farm income.

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