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Weed menace and nature of weed-crop competition in perspective of Bihar

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ABSTRACT : Of the more than 300,000 species of plants known in the world, hardly 3,000 are of economic value to us. When one grows any of these economic species of plants, invariably, a variety of volunteer vegetation comes up simultaneously which is competitive and undesirable. This results into competition that is defined as the action of endeavoring to gain what another endeavors to gain at the same time. Among plant communities each plant is in a state of continuous competition with its neighboring plants for various growth elements, both above and under the ground. Volumes of research into the primary elements of weed-crop competition have drawn our concern to mineral nutrients, moisture and light. Weed-crop competition for ground space is not usually upheld by the modern researchers.

KEY **W**ORDS : Allelopathy, Competition, Menace, Weeds, Yields

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Weeds are simply the plants that could be undesirable at one place and desirable, or of little concern at the other. Bermuda grass (*Cynodon dactylon),* foxtail (*Cenchrus ciliaris)* and goosegrass (*Eleusine indica),* etc. are valuable plants in pastures, but in crop fields these are well known inapposite troublesome weeds. Despite of these advantages they are considered disadvantageous as they cause economic loss to these aspects:

– Weed menace in agriculture
– Weed menace in animal husbandry
– Weed menace to human health
– Weed menace to aquatic ecosystems
– Weed menace to industry and public utilities
– Weed menace to forests and pastures.

Weed menace in agriculture :

Weed problem in almost majority of crops is quite common in Bihar due to poor financial condition of the farmer. They are ubiquitous and insidious tyrants on earth. Their presence in and around agricultural land inflicts enormous losses which must be borne by majority of the farmers. Generally, weedy crop does not distract a passer-by till it comes to harvesting but the fact remains that directly the weeds reduce the crop yields and indirectly, they elevate farm production cost through energy spent in controlling them.

Recent estimates by an Indian industry chamber, Assocham, placed the collective crop losses due to weeds, insect pests and plant pathogens in India at Rs. 14 lac million. It has been estimated that weeds contribute upto 25 per cent of the total losses incurred.

Reduction in crop yields and production efficiency:

Exhaustive data are available on the losses caused by uncontrolled growth of weeds in the productivity of different crops. On country basis losses have been estimated at 15-30 per cent in wheat, 30-35 per cent in

rice and 18-85 per cent each in maize, sorghum, pulses, and oilseeds (Mukopadhyay, 1974). But as the farmers adopt some kind of weeding in their fields, it still leaves us with a conservative estimate of at least 10 per cent reduction in crop yields.

Besides the direct reductions in crop yields inflicted due to presence of weeds, there are many indirect ways by which the weeds may be troublesome in agriculture. For example, in weedy fields farm operations like fertilizer application, insecticides and irrigation become cumbersome. Even when a crop is made despite the presence of weeds, it may be difficult to harvest it, particularly when prickly weeds like wild safflower (*Carthamus oxyacantha*) canada thistle (*Cirsium arvense*) and cocklebur (*Xanthium strumarium*) invade the fields. Cowage (*Mucuna pruriens*) riles the harvest

Table 1 : Losses in crop yields caused by uncontrolled growth of weeds

Crop	Yeild in q/ha			Source
	Weedfree	Weedy	Loss(%)	
Food crops				
Wheat	27.7	18.2	34.3	Tiwari and Parihar (1993)
Barley	41.6	25.2	39.4	Balyan and Malik (1994)
Rice	68.9	21.1	69.4	Singh *et al.* (1991)
Sorghum	53.0	36.8	30.6	Satao and Nalamwar (1992)
Pearl millet	34.6	19.6	43.4	Kumar and Shaik (1993)
Maize	31.8	13.1	58.8	Sharma and Natiyal (1993)
Chickpea	20.6	10.4	49.5	Singh and Singh (1992)
Blackgram	13.5	9.4	30.4	Rita *et al.* (1995)
Greengram	11.2	5.8	48.2	Sandhu *et al.* (1992)
Lentil	23.6	13.5	42.8	Parmar *et al.* (1994)
Peas	19.0	11.9	37.4	Kundra *et al.* (1993)
Redgram	16.5	10.8	34.5	Vaishya (1993)
Fatty oil crops				
Groundnut	28.6	10.5	63.3	Yadav *et al.* (1986)
Mustard	18.5	12.3	33.5	Yadav *et al.* (1995)
Soybean	20.8	12.7	38.0	Singh and Kolar (1994)
Sunflower	15.4	11.4	26.0	Patel *et al.* (1994)
Fibre crops				
Cotton	23.4	12.3	47.4	Panwar *et al.*(1995)
Jute	21.5	11.1	48.4	Singh *et al.*(1994)
Sugar crops				
Sugarcane	763.0	467.0	38.8	Chauhan and Singh (1993)
Sugarbeet	802.0	238.0	70.3	Srivastava and Singh (1979)
Vegetable crops				
Cauliflower	80.8	41.6	48.5	Porwal and Singh (1993)
Okra	106.8	10.9	89.8	Singh *et al.* (1993)
Carrot	134.2	35.6	73.5	Singh *et al.* (1983)
Onion	230.9	21.5	90.7	Singh and Singh (1994)
Potato	188.0	135.0	28.2	Singh and Lal (1994)
Other crops				
Fodder maize	374.3	119.0	68.2	Singh and Prasad (1994)
Mint	257.0	41.0	84.0	Jaidev *et al.* (1993)
Tobacco	1373.0	293.0	78.7	Raghuvanshi and Sannibabu (1991)

labour by itching. Bindweed (*Convolvulus arvensis*) and morning glories (*Ipomoea* spp.) bind the crop plants together so well that their harvesting becomes almost impossible. The weeds at harvest time also bring about excessive wear and tear of farm machines. Add to this cost of separating weed seeds (and fruits) from the grain and other farm produce. There is yet another way the weeds limit our annual agricultural production. This is by permanently occupying the thousands of hectares of otherwise productive land and taking these out of cultivation.

Moreover, weeds do provide shelter to insect pests and disease causing organism of crops and act as alternate hosts to these, both during the crop season and off season. Later, they migrate to the main crops where they inflict high intensity damage. Some examples of weeds found in Bihar that act as alternative host of crop pests and diseases for providing feed, shelter or reproductive sites are discussed below (from: Doederlein and Sites (1993); Durant *et al.* (1994); Ellis (1992); Hu and Nie (1989); Jaidev *et al*.(1993); Larson (1994); Shanower *et al.* (1993); Suhardi (1993) and Yang *et al.* (1994).

Erosion of crop quality :

Weeds mar the quality of farm produce in many ways. Contamination of food grains with weed seeds, particularly of poisonous nature, fetches low price. The weedy grains produce flour with bad odour.In warehouses the weed seeds and weed fragments continue respiration and thus, cause the grain to heat and rot. In Bihar, reports

Table 2 : Alternative host of crop pests and diseases for providing feed, shelter or reproductive sites

Host weed	Pest/disease organism hosted	Crop affected
Weeds hosting insect-pests		
Aeschynomene sp.	Grasshoppers	Rice
Achyranthus sp.	Leaf eating caterpillar	Lucerne and maize
Brassica kaber	Aphids	Brassica crops
Ipomoea sp.	Melon aphis	Melons
Chenopodium album	Stalk borer	Tomato
Amaranthus sp.	Gram caterpillar	Readgram, cotton
Crotolaria sp.	Hairy caterpillar	Castor
Digera arvensis	Caterpillars	Tobacco
Echinochloa sp.	Stem borer	Rice
Kochia sp.	Thrips	Onion
Solanum sp.	Weevils	Bell pepper
Tinospora cordifolia	Fruit sucking moth	Citrus
Trianthema sp.	Greasy cutworm	Potato
Weeds hosting plant pathogens		
Agropyron sp.	Wilt	Tomato
Stelaria sp.	*Aphanomyces* sp.	Spinach
Cynodon dactylon	Sting nematode	Several vegetables
Cenchrus ciliaris	Ergot	Pearl millet
Commelina sp.	Viruses	Banana
Daucus carota	Blight	Carrot
Euphorbia hypersifolia	Anthracnose	Shallot
Leersia oryzoides	Bacterial blight	Rice
Melothria pendula	Mosaic vectors	Water melon
Plantago sp.	T.M. Virus	Tobacco and tomato
Salsola kali	Curly top virus vectors	Sugarbeet
Saccharum spontaneum	Downy mildew	Maize
Solanum sp.	Mosaic and cyst nematode	Tobacco

state that weeds cause severe moisture stress and force the grain to shrivel in case of rice, mustard, etc. The vegetables and fruits are discolored and deshaped in presence of weeds.

Causes of such losses :

Scientists at Department of Agronomy, Dr. Rajendra Prasad Cental Agricultural University, Pusa, Bihar states that weeds not only cause above losses as such simply stated above. Behind these, there is a mechanism generally termed as weed–crop competition. This refers to a competition between the weeds and the crops growing on agricultural lands which tends to limit, or even extinct, the weaker competitor; invariably the crops. In fact without the selfish interference by man, the weeds can easily wipe out the crops from earth in comparatively short period. By their weedy nature the weedy plants are adapted to thrive at the expense of our "refined" field and plantation crops.

Reasons for weed-crop competitions are enlisted below :

Competition for nutrients :

Weeds usually absorb mineral nutrients faster than many of our plants and accumulate them in their tissues in relatively larger amounts. Species of *Amaranthus*, for example, often accumulate over 3 per cent N in their dry matter and fall into the category of nitrophills. *Digitaria* sp., on the other hand, is a phosphorus accumulator with phosphate content of over 3.36 per cent. *Chenopodium* and *Portulaca* sp. are likewise potassium lovers, with over 4.0 per cent potash in their dry matter. More interesting is the example of *Setaria lutescens* which accumulate zinc. The Zn concentration of this weed may be up to 585 ppm of dry matter. At this level it amounts to removal of about three times more zinc by this weed than by an average cereal crop. In Bihar, maize fields were estimated to lose each year about 118g Zn, 45g Cu, 190 g Mn, and 4765g Fe per ha in weeds. Porwal and Gupta (1986) estimated the average nutrient removal from wheat field as 32.45 kg N/ha and 5.07 kg phosphate/ha during the crop season.

Competition for moisture :

In general, for producing equal dry matter, weeds transpire more water than do most of our crop plants. Therefore, in dryland agriculture the actual evapo-transpiration from weedy crop fields is much more than the evapo-transpiration from a weedfree crop field. In such a system, during a dry spell the weedy crops exhibit wilting or the moisture stress symptom much earlier than a weedfree crop.

Table 3 : Transpiration co-efficients of certain weeds and crops (Kanitkar *et al.*,1960)

Weeds	Transpiration co-efficients
Amaranthus viridis	336
Cynadon dactylon	813
Echinochloa colonum	674
Tribulus terristris	221
Tridax procumbens	1402
Crops	
Zea mays	352
Sorghum vulgare	394

Competition for light :

An important feature of competition for light in plant communities is that unlike competition for N and moisture, once the crop seedlings are shaded by weeds, later on providing additional solar energy cannot make up for the crop stunting caused earlier. Hence, crops like potato, vegetables, etc. suffer to great extent here in Bihar.

Allelopathy :

Green plants produce numerous secondary metabolites, many of which are capable of initiating chemical warfare among the neighbouring plants growing in a community. These chemicals have been designated as allelo-chemicals and the process as allelopathy. The allelopathic compounds may be released from plants into the soil as either root exudates or as decomposition products of their dead and worn-out tissues. Some weedy plants have also been found to release volatile allelopathic for, their foliage which prove unhealthy to nearby crop plants. The allelopathic compounds studied so far are found to largely belong to two chemical groups *viz.*, the phenolic compounds and the terpenoids, which comprise molecules like benzoic acid, cinnamic acids, phenolic acids, etc. (Rizvi and Rizvi,1992).

Conclusion :

The weeds constitute a major problem in agriculture and the losses due to them are far greater than are usually realized. Farmers in Bihar as well as complete India spend a major part of their life fighting weeds and weed hazards as the cost of removing weeds adds to the cost of

production thus, reducing their income. Therefore, it is important that they are controlled in time to avoid unproductive use of plant growth factors by them and enable the crop plants to fully utilize nutrients and express their true potentiality. In fact, any weed must be curbed on farmland at the earliest opportunity, preferably, before it had chance to germinate and compete with our plants, directly or indirectly. Thus, any research efforts on the utilization of weeds occurring in agricultural fields are unnecessary and not in line with the principles of good weed management. Moreover, weed-crop competition is critical in obtaining optimum crop yields because of far greater competing ability of the weeds than crops. Weeds deplete the crop fields of large quantities of mineral nutrients and moisture, shade of the crop seedlings and vie for the space where the crop plants should grow their roots. Besides, the weed inflicts their *allelopathic* effects on crop plants which are largely through their depressive root exudates. Only way to handle this menace is more and more experiments and extension activity. Hence, strong research and development (R and D) efforts are needed to minimize weed-crop competition as it has not yet been upheld by modern researchers.

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