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RESEARCH ARTICLE

ECOLOGICAL/CULTURAL MEASURES OF WEED MANAGEMENT FOR SUSTAINABLE AGRICULTURE

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ABSTRACT

The weed is a plant that grows where it is undesired or in its place. Weeds are unwanted plants that are not known to be economically important. Weeds are plants that are unwanted in a given situation and may be dangerous, harmful or economically detrimental. Weeds have serious problems when it comes to agricultural production. It is estimated that weeds generally cause a 25% loss of agricultural production in the least developed countries, a 10% loss in the least developed countries and a 5% loss in most developed countries. Weeds loses are depend upon location, crop and types of soil. The study found that potential yield losses were significant for soybeans (50-76%) and peanuts (45-71%). Largest variability in potential yield losses were observed among locations in case of direct seeded rice (15-66%) & maize (18-65%). In similar cases weeds are reduced 66% yield of Chilly and the loss of N through weeds is about 150 kg per ha. Weeds losses alone in 10 major crops of India viz transplanted rice (13.8%), wheat (18.6%), direct-seeded rice (21.4%), mustard (21.4%), sesame (23.7%), sorghum (25.1%), maize (25.3%), Pearlmillet (27.6%), Greengram (30.8%), soybean (31.4%) and groundnut (35.8%). Weed control practices are extremely important to Indian agricultural production. Many more tools and practices are adopted for crop protection q like crop species, crop variety/cultivars, sowing of crop (time, rate of sowing, row spacing and method), crop rotation, trap and catch crops, cropping practice, irrigation time & method are suitable practices under cultural/ecological measures of weed management. Cropping practices are also known as environmentally responsible weed management practices. Environmentally sound weed management methods are chemical-free and weed management tools-free.

KEYWORDS

Weeds, Yield loss, Crops, Ecological management.

1. INTRODUCTION

The term weed seems to be originated from German word 'Weyt' & 'Dutch' word 'weet' and 'weed', Belyian word weed. A Great Britain farmer jethro Tull was the first person to use the term weed as a plant growing where it was not desired. First time Weeds related terms and information was published on the book of 'New Horse Hoeing Husbandry'. A plant growing out of place is called weed. A weed is a plant growing where it is not desired or any plant that is founded out of its place. According to weed science society of America definition "weeds is a plant growing where it is not desired" (Buchholtz, 1967). WSSA was revised his definition any plant that is objectionable or interfere with the activities or welfare of man. 'EWRS'1986 defined a weed as "any plant or vegetation, excluding Fungi, interfering with the objectives or requirements of the people". A Weeds as "any plant that is objectionable or interferes with the activities or welfare of man" (Humburg, 1989). A weed is a plant that is considered undesirable in a particular situation or location, a plant in the wrong place. Weeds are plants that are not intentionally sown or reproduced by the grower and need to be managed to prevent them from interfering with livestock or crop production. It is the situation involving space and time and individual interest in this situation that classifies a plant as a weedy. Weeds are underestimated crop pests although they causes the higher loss/reduction in yield of crops than other pests and diseases (weeds= 40-45%, insects= 30%, diseases=20%, other pests=5-10%).

Weeds are undesirable plants; however, not all undesirable plants can be weeds. In the case of pastures, the foxtail (*Cenchrus ciliaris*) and the bermuda (*Cynodon dactylon*) are precious plants, but in the fields, they form annoying plants. Similarly, quackgrass (*Agropyron repens*) are serious weeds in crop fields and orchards, but it very good plant for binding certain erodable lands. Lantana (*Lantana camara*) on thousands of hectares of agricultural lands, river beds and grazing grounds, it has spread as a naxious weed in the country but its Multi-Color flowers has frequently attracted the gardeners who train it in different fashions. Thus, it is the situation, time and space involved, and individual interest in this situation, which categorizes a plant as a weed. Despite the good intentions of the above accepted definitions of weed, for all purpose & intents, about 30000 plants species have been identified as define weeds in the world infestation crop lands, woodlands, orchards, Water-bodies, air fields, utility rights-of-way, etc. (Gupta, 2010). Knowledge of morphology is the most important way of identifying weeds.

2. WEED ECOLOGY

Weed ecology is the study of the relation between weeds and their environment (other living organisms and abiotic factors). Ecology is a

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concern about growth characteristics and adaptations that allow weeds to survive environmental change. Human play an important role in changing the environment by changing livestock practices and maintaining a multi-crop or weed-free mono-crop to effectively control weeds. In the past, the understanding of weed ecology has been a weak link in a weed management, when in fact the ecology of a weed species could be the most important tool to determining the correct course of action. Some fundamental aspects of weed ecology involve the classification of weeds and their characteristics. Weed classification can include population dynamics (reproduction, growth form, habitat, life cycle and seed type). Some characteristics of plant that support weedi-ness include rapid seed germination, the ability to take up & utilize large amounts of nutrients, rapid growth, prolific seed production, seed characteristics that promote dispersal, mechanisms, seed dormancy, continual flushes of germination, high tolerance to stresses, and the ability to adapt to various environmental conditions,

3. Weed Biology

Weed biology is an integrated science with the aim of minimizing the negative effects, as well as using & developing the positive effects of weeds. Study of weed biology is essential for development of both environmental & economically acceptable weed management systems. It is a part of weed science devoted to the study of the establishment, growth developed, reproduction and life cycle of weeds. Important component of weed biology are seed production, dissemination of seed, seed germination and vegetative reproduction. In case of annual weeds; 1st 3component are important. For control of perennial weed we have to cheek vegetative part of weed.

4. Characteristics of Weed

crops and weeds both are plants, there are certain distinct feature of weeds some of which are helpful to plan weed control strategy. In general weeds are produce large number of seeds per plant compared to crop, in case of annual weeds characterized by the number of seeds in the arable soil is large. for example, seed production capacity of *Amaranthus spp.* was found to be 196,000 seed/plant, *Portulaca sp.* 193000 seed/plant, *Solanum nigrum* 178,000 seed/plant, *Cuscuta spp.* 16,000 seed/plant, *Chenopodium album* 72000 seed/plant, *Trianthema sp.* 52,000 seed/plant, *Eleusine indica* 41,200 seed/plant, *Commelina benghalensis* 2,450 seed/plant, *Cynodon dactylon* 170 seed/plant, *Cyperus rotundus* 40 seed/plant (Reddy, 2016). Its seed remain viable for many years, of wild growth, competitive & aggressive habit, concept of growing in undesirable location, all seeds of weed mature simultaneously, spontaneous growth appearing without being sown or cultivated.

Weeds are harmful to man, animals, crop. Weed generally produce large number of Propagules & they may also have vegetative reproduction methods. Some weeds have very deep root system sometimes (25-30) feet, Eg. *Commelina, Cyprus rotundus.* Weeds are store food in their rhizome, and continue their growth eg. Saccharum spontance. Weeds are hardy and can persist adverse climatic condition like high temperature and drought and they can multiply because of high resisting capacity. And some weed seeds very similar to crop seed. Eg, Mustard & *Argemone Mexicana,* Onion & Aspodullus. If a weed is cross-pollinated, pollination is a accomplished by nonspecialized flower visitors or by wind (Zimdahl, 2007).

5. Losses From Weeds

Definitions of weeds usually include trouble with crops, harm to animal or harm to people. Most people do not consider plants to be bad. They are assigned the derogatory, descriptive term weed because of something they do to us or to our environment; they interfere with activities or welfare of man. Loss in crop, more-than 7000 crores. It is estimated that weeds alone contribute to loss of 40.8% in monsoon season and annual average crop loss is considered to be 11.5% worldwide or 287.5 mt. Among the annual agriculture loss in india, weeds account for 40- 45%, insect 30%, disease 20% and other 5-10%. Annual losses caused by weed in the agriculture of developing countries have been estimated to be 125 mt of food, a quantity sufficient to feed 250 million people (Parker and Fryer, 1975). An annually, weeds compete with plants for water, sunlight, space and nutrients. Generally increasing of 1 kg of weeds growth correspond to reduction in 1 kg of crop.

Weeds increase the cost of labour and equipment which ultimately increase cost of cultivation. Weeds interfere with farm operations and decrease efficiency of farm equipment. Reduction in land value, heavy infestation by perennial weeds could make land unsuitable or less suitable for cultivation, eg. Typha, limited choice of crops. Crops differ in ability in competing with weeds. Presence of weeds limit the choice of crops, loss of quality of the farm produce, loss of animal health and some weeds are poisonous. Some weeds are menace to human health.eg; Parthenium causes allergies and mechanical injuries. Weeds provide food, shelter and act as host for vector of diseases. Weeds help in contamination of water body, change appearance & taste of drinking water. They hamper zero activities like boating & swimming. Weeds on industrial sites are potential source of fire. They affect efficiency of industrial workers. Weeds cause loss of forest & woodlands like undesirable trees gradually replace the woodland spp. Weed free buffer strips are essential in forest and woodlands.

6. Importance of Weeds

Many weeds are beneficial for the human body. So many weeds are utilizing in different aspects like green manure purpose use and add considerable amount of organic matter & plant nutrients. Weeds are providing about 5-15 tonnes of green matter/hectare depending upon weed species & their growth. Nutrient contents of Gokhru (*Xanthium strumarium*), Bavachi (*Psoralea corylifolia*) and Leguminous weeds are provide: 3-3.5%, 3-3.5% and 1.5-6% calculated, (source: agriinfo.in). Weeds are improving the levels of nitrogen availability; leguminous weeds can increase crop yield by fixing nitrogen. The application of the weed *Argemone Mexicana* @ 2.5 tonnes/ha is useful for reclamation of alkali soils. Cactus & Ghaneri (*Lantana camara*) are used as ornamental & hedge plants. Certain weeds have Nematicidal properties: *Calotropis spp., Parthenium and Crotalaria spp.* etc. are incorporated in to the soil to controlling nematodes.

Some weeds can be used for bio-gas, paper pulp & manufacture of edible proteins. Weeds are helping to conserve soil moisture & prevent erosion. Weeds are providing food for wildlife, especially birds and helps to conserve soil moisture, prevent erosion & leguminous weeds can increase crop yield by fixing nutrients, conserve nitrogen especially on light soils. Weeds are serving alternate food source; basically, used for fodder purpose and also used for mulching purpose basically protecting the soil surface from solar radiation, that's improves the soil microclimate; including the temperature and moisture level.

7. Cultural / ecological Measures of Weed Management

A crop must have initial vigorous growth to become more competitive against weeds. It should germinate and grow faster than weeds and form a closed plant stand and enough coverage rapidly, which imposes shading effect to weeds. Cereals because of their tall stature prove more competitive against short-stature weeds. Wheats are more competitive against short *Melilotus indica/alba, Spergula arvensis, Fumaria parviflora, Polygonum sp.* etc. Crops having good weed smothering ability should be chosen for cultivation.
Eg:-

1. Cowpea:- it is a more competitive with higher weed smothering capability than green gram or black gram.
2. Barley is more competitive than wheat.
3. Sorghum has allelochemical HCN.
4. Maize major source of allelochemicals is root exudates and maize is allelopathic to *Chenopodium album, Amaranthus retroflexus.*

7.1 Crop variety / cultivars

Crop cultivars too vary in their ability to compete with weeds, basically on the same principles as crop plants do. Greater the height of a crop genotype, greater was weed suppression. Significant reduction in density, dry weight and height of *Phalaris minor, Chenopodium album & Melilotus indica* in association with tall wheat genotype (C306) compared to dwarf variety (Wl,1562). In rice too tall and dwarf cultivars showed a wide range of variation in their competitive abilities against weeds. Weed growth in compact genotype of pigeon pea (Var. HY-34) was 37% higher than spreading variety (ST-1).

7.2 Sowing of crop (Time)

Time of sowing of crops influences weed competition. If initial big flush of weeds germinating at one point of time is bypassed through manipulation of the time of sowing of a crop, a little earlier or later than its normal time of sowing the crop may germinate and have initial growth under almost weed-free or less weedy environment. Eg-Late planting of wheat in December than its normal sowing in mid-November in north and western India reduces *phalaris minor* problem. Maize, cotton sown 15 days before the onset of usual monsoon rains with pre-sowing irrigation proved beneficial towards reduction of weed competition.

7.3 Sowing of crop (Method)

Line sowing normally encounters less weed infestation and provides more ease of controlling them than broadcasting. In the summer season, furrow planting of crops is also useful for reducing weed growth. In wheat, FIRBS (Frrow-Irrigated Raised Bed System) has been found useful in reducing overall weed competition in wheat mainly on the raised bed, but the furrows get highly populated with weeds. Cris-cross sowing in wheat and transplanting in rice are other planting methods, which generally encounter less weed problem.

7.4 Sowing of crop (rate of sowing and row spacing)

High seed rate and higher the density of a crop lowers is weed competition & vice-versa. The crop density, cannot be increased infinitely since every crop has an optimum population beyond which intra-specific competition among crop plants may begin. Increasing wheat plant density by reducing row spacing from 20 cm to 15 cm could reduce the dry weights of Lolium and Phalaris by 11.9% and 18.3% respectively.

7.5 Crop rotation

Crop rotation is considered as a solution for controlling several insect pests, diseases & weeds under crop field ecosystem so for maintaining soil health & sustained crop production. It is highly effective against parasitic weeds such as *Striga sp*. (mainly in sorghum & maize), C*uscuta campestris* (niger), O*robanche* (Brassicas & solanaccous crops), *Cuscuta epilinum* (linseed) and cropassociated weeds like *Avena sp.* & *Phalaris minor* (in wheat) and *Echinochloa colona/crusgalli* (in rice). Eg- mustard, vegetable pea, potato is if adopted in sequence after rice during winter season. *Phalaris* problem could be reduced to a great extent in north-western wheat belt of India.

7.6 Trap and catch crops

Trap and catch crops should be included in crop rotation particularly for controlling parasitic weeds *Striga & Orobanche.* Trap crops are nothing but false hosts, which exude S*triga* germination stimulants & induces *Striga* seed germination, but after germination *Striga* may die-out with lack of suitable host. This is called suicidal germination. Cotton, sunflower, soybean, cowpea, pigeon pea, jute, chick pea, kenaf and groundnut are trap crops for *Striga*. Catch crops, on the contrary, are parasitic weed-susceptible verities of a crop or crops, which are grown and ploughed buried into soil prior to the flowering of parasitic weeds and sowing of a crop of principle interest. Catch cropping however, often faces problem of shortness of the growing season.

7.7 Cropping practice

Inter-cropping system to become efficient in terms of production & weed control. It is generally held that inter-cropping or mixed cropping is more remunerative than sole cropping under rainfed, unirrigated conditions but under assured irrigation, sole crop may prove superior on yield output. Several inter-cropping like sugarcane+green gram / black gram, maize+soybean /black gram, sorghum+coepea, wheat+gram is reported beneficial towards weed control. Intercropping short-season crops with longer season crops prevents weeds from adapting to the growth cycle of either of the crops. Low-growing crops (sweet potato) with maize, cassava & yain as inter-crops suppressed weed growth

7.8 Irrigaton time and method

If wheat is normally sown with a pre-sowing irrigation *Avena ludoviciana* (wild oats) starts germination along with wheat. Therefore, if the first irrigation is delayed beyond 3WAS, there won't be much germination of *Phalaris* and wild oat under late irrigation

7.9 Fertilizer management (kind, time, method and rate)

Centella asiatica occupying 35% of the vegetation in non-fertilized plot, was completely suppressed by fertilizer. The N-P-K fertilizers affect weed diversity and species distribution. Acidic fertilizer like ammonium sulphate, ammonium chloride, Urea may acidify the soil and discourage leguminous weeds. Addition of N to wild oat-infested wheat increased the density of wild oats panicles and decreased wheat yield, split N application in that situation incurred more yield loss due to wild oats. The N-P- and K-fertilizer need to be banded, side dressed or placed below the crop rows before sowing and there should not be any contact between fertilizer & crop seeds. *Phalaris minor* growth was reduced when N was applied at 150 kg/ha than at 120 kg/ha. *Striga* germination reduced drastically at higher concentration of N in soil.

7.10 Stale seedbed

Stale seedbed technique dictates that a field should be irrigated first and then it is ploughed on optimum moisture status and levelled thoroughly. Crop is withheld from sowing and the field is left as such for about a week or more to allow enough germination of weeds, which later will be controlled by a non-residual herbicide, e.g. paraquat glyphosate, or by shallow cultivation. Weed population was reduced by 40-50% and wheat grain yield increased by 50.7% in stale seedbed compared to conventional seedbed. The land was prepared 3-4 weeks before sowing with minimum soil disturbance followed by paraquat application.

7.11 Summer fallowing

Following is a cheap and effective practice of weed control. Fallowing during summer accompanied by 3-4 tillage (of which the first one should be a deep tillage) exposes weed seeds, under-ground vegetative structures of perennial weeds (e.g. *Cyperus rotundus, Cynodon dactylon, Digitoria scalarum, Cirsium arvense or Convolvulus arvensis*), insects, pathogens, nematodes to the host sun and kill them by solarization. Simple fallowing, however, may not yield a good result.

REFERENCES

Buchholtz, K.P., 1967. Report of the terminology committee of the weed science society of America. Weeds, 15, Pp. 388-389.

European weed Res. Soc. 1986. Constitution Eur. Weed Res. Soc. 15 pp.

Gupta, O.P., 2010. Weed Management. 3rd ed. Jodhpur: Agrobios, Pp.1-2.

Humburg, N.E., 1989. Herbicide handbook, 6th ed. Weed sci. Soc. Am., Champaign, IL, Pp. 301.

Parker, C., Fryer, J.D., 1975, Weed control problems causing major reductions in world food supplies, *FAO Pl. Prot. Bull.,* 23, Pp. 83–93.

Reddy, S., 2016. Principles of Agronomy. 5th ed. Ludhiana: Kalyani Publishers, Pp. 490-491.

Zimdahl, R., 2007. Fundamentals of Weed Science. 3rd ed. Oxford, USA: ELSEVIER, Pp. 20-21.