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A REVIEW

Weed management in organic farming

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Abstract : The enhancing requirement for organic products seeks at resolving difficulties of organic production systems. Primary hindrance for this production system is weed management. The base of weed control in organic farming is cultivation. Organic farmers implement eco-friendly management practices against less efficiency products, uncertain weather conditions, cost, potential hazard to soil health. System level practices that include crop rotation and cover cropping mostly recognized as weed management weapons. Somehow weed control should be implemented with proper knowledge of weed biology and these operations may get less profit or even enlarged weed population. Organic farmers embrace new management systems to enhance the outcome of pre-existing practices. Invention of modern cultivation tools leads to improved efficiency, faster and better working rate shows good result in control of weeds. Eco-friendly management practiced with the support of these tools centralize on reducing weed, increasing crop-weed interference will produce reliable weed management systems for organic farming.

Key Words : Organic farming, Weed management, Crop rotation, Cover cropping, Weed biology

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INTRODUCTION

Weed management is the key aspect of organic farming system. The farmers have always faced huge loss due to the presence of weeds in their fields. Weeds are the most common threats to agricultural production. The term "weed" is defined as an unwanted plant species that counter with the crops in a particular field at a particular time. Neither it is intentionally sown nor incorporated by the farmer. Weeds are required management to halt it from interaction with the crops.

Weeds are recognized as a note-worthy problem for their increasing population with respect to crop that significantly leads to competition for water, sunlight and nutrients. It also becomes host plant for pest and diseases. Since the application of herbicides are done to eradicate weeds from the crop field, in organic farming system

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use of chemicals that resulted soil environment toxic, health problems are strictly prohibited. It has to be considered that in organic farming system, weeds are never eradicated, but it can be managed.

Weed management in organic farming has evolved in such a way that application of many strategies and invention of new technologies leads to achieve economically desirable weed control and higher yield of crops (Davies and Rosenfeld, 2004; Davies and Turner, 2004; Davies *et al.,* 2005 and 2006 and Davies and Turner, 2004). Farmers always like to obtain a zero level of weeds on the field. This may noy be possible practically, but can be reduced significantly. Weeds can be cut or pulled out, but it depends on how much money and time a farmer can invest to reduce weed population. The more will be the weed population, the yield will be more economical. For better weed management strategy, it is necessary to understand what resources weeds need to grow in that particular place.

Weeds access water, nutrients and light for growth like other plant species. The main aim for the crop to outcompete the weed by reducing the availability of resources. If the farmer can provide the crop and advantage by organically achievable techniques to compete with the weed, weed management can be successful. The chief aim of sustainable weed management is to reduce the potential hazards of weeds on crops.

Critical weed control period:

Critical period of weed control is defined as the duration in the crop life cycle to prevent yield loss by keeping weed free. The weeds have to control during this critical period so that the weeds that arise later will not affect much the yield. However, some crops like Horticulture crops have to keep weed free though these are very sensitive to weed competition. Critical weed free period for some of the horticultural crops are mentioned in Table 1.

Table 1: Critical weed free period for horticultural crops

Crop	**critical weed free period**
Cabbage	3 weeks after planting
Carrot	3-6 weeks after emergence
Lettuce	3 weeks after planting
Onions	The whole season
Potatoes	4 weeks after planting
Tomatoes	36 days after transplanting
Apples	Bud break until 30 days after bloom
Beets	2-4 weeks after emergence

Cultural practice :

Crop rotation :

Crop rotation is a process to alter different crops in an organized sequence on the same land. It is a key strategy for generating a long term weed control system. In Monoculture, same crop grows in the same land year after year which result adaptation of weed species. When different crops are grown in a rotation, weed germination cycle are hampered by cultural method variations with every crop.

Within a rotation, choice of crop will decide both the current and the possible future weed difficulties that a farmer will counter. Potato (*Solanum tuberosum* L.) was involved in the rotation to inhibit weed difficulties before a less competitive crop was cultivated conventionally. For an organic farmer, choice of crop is convoluted auxiliary by the requirement to determine levels of soil fertility within the cropping pattern and to involve fertility generating time in the crop rotation. Crop variants and weed reactions to levels of soil nutrients can also performa crucial part in weed control.

Cover crops :

Weeds can be supressed by rapid growth and condensed ground covering by the crop. The addition of cover crops like red, clover, rye, oilseed radish or over winter crops such as winter wheat and forages in the cropping system can control growth of weed. During crop rotation greatly competitive crops can be raised as short duration 'smother' crops. Moreover, cover crop remains on the surface of soil will control weeds by covering and cooling the soil. Whileselection of a cover crop, we should always consider how the cover crop will adopt the successive crop. Furthermore, decaying cover crop remaining may dischargeallelo chemicals that supress the germination and growth of weed seeds.

Intercropping :

Intercropping involves cultivation of two or more crops at the same time on the same field. Intercrops are capable ofcontrolling weeds. The application of intercropping as an approach for weed control should be done carefully. The intercrops can prominentlylessen the harvests of the main crop if competition for nutrients and water takes place.

Field survey :

It comprises the organised assemblage of weed and

crop information like weed dispersal, development stage, weed population, crop stage etc from the field. The data is applied in the short tenure to createabrupt weed management strategies to decrease or evade economic crop forfeiture. Field inspection is key in assessing the achievement or failure of weed management programmes and for making healthy judgements in future.

Mulching :

Mulching or covering the surface of soil can inhibit weed seed germination by obstructing light transmission halting seed germination. Allelopathic chemicals in the mulch also can tangiblyprevent seedling occurrence. There are many types of mulches obtainable. Three common ones are listed.

Living mulch :

Living mulch is a species that sprouts thickly and minimal to the ground like clover. Living mulches can be planted before or after a crop is set up. It is necessary to destroy ad till in, or control living mulch so that it does not contend with the genuine crop. A living mulch of *Portulaca oleracea* from transmission before uprooting broccoli control weeds without changing crop yield. The main objective of living mulch is to upgrade structure of soil, foster fertility or decrease pest problems and weed control may be simply an additional profit.

Organic mulches:

Materials like bark, straw and composted material can provide efficient weed control. Generating the material on the farm is suggestedas the value of procured mulches can be expensive, reliant on the quantity required to overwhelm weed appearance. An efficient but labour-demanding method applies newspaper and straw. Two coats of newspaper are arranged on the ground, tailed by a coat of straw. It is essential to confirm the straw does not comprise any seed of weed. Organic mulches are biodegradable. Cut rye grass mulch scattered among rooted rows of peppers and tomatoes was more cost-effective than harvesting.

Fresh bark of conifers, rapeseed straw alongside oak gave better weed control results when they were reposed as mulches under the trees in apples orchards. Materials like black polyethylene have been applied to supress weed in a wide range of crops in organic farming systems. Plastic mulches have been extended that separate out photosynthetically active radiation, but allow in infrared light to warm the soil surface. Infrared transmitting mulches have been proved to be useful at supressing weeds.

Planting patterns :

Several factors like crop population, choice of variety and spatial arrangement can impact growth of weed. For example, findings have revealed that taper row widths and a larger seeding mass will inhibit the biomass of later-arising weeds by decreasing the quantity of light obtainable for weeds placed down the crop covering. Likewise, fast growing varieties can have a modest superiority over the weeds.

Variety selection :

Precise choice of crop diversity is necessary to restrict weeds and pathogen hitches and to gratify market requirements. Any crop species that is capable of awning the soil amid the rows and is also capable of sprouting more swiftly than the weeds will have a benefit.

Tillage system :

Tillage systems modify the soil seed bank subtleties and deepness of conceal of weed seeds. Reports have suggested that nearly 75% of the seedbank was resolute in the upper 5 cm of soil in no-till land. In the moldboard plough system, the seedbank is more evenly dispersed over depth. Other preservation tillage systems are intermediary to these two systems.

Weed seedling appearance is often more eventhin buried weed seeds and may show much better weed restriction. Weed seeds precise to the soil are more expected to be destroyed by animals, insects and other predators and disease causing organisms.

Sanitation :

It is promising to inhibit many new weeds from being familiarised onto the farm and to block standing weeds from generating huge amounts of seed. The application of fresh seed, cutting weeds around the boundary of fields or after cultivation to preclude weeds from going to seed, and comprehensively composting manure before use can vastly decrease the initiation of weed seeds and problematic weed species. It is even achievable to choosy hand-hand-eliminate secluded eruptions of new weeds, efficient enough by evading future influxes. Plantation of fresh, top-quality seed is necessary to crop achievement. Other sanitation factors reflection consists

of hygiene of any machinery which may have been applied in weedy fields, and the introduction of hed gerows to restrict windblown seeds.

Nitrogen fertility :

Nitrogen fertilizer can impact the race among weeds and crops and in the successive crops. For instance, nitrate is suitable to enhance seed germination and seed production in some of the weed species. Nitrogen fertilization may cause in enhanced growth of weeds rather than enhanced crop harvest. Choosy setting of nitrogen in a band can support the crop over the weed. Application of legume remains are resisted to chemical nitrogen fertilizer to addon nitrogen requirements of the crop can increase weed inhibition. Legume resules release nitrogen deliberately with lowspur of undesirable weed development.

Feed the crop, not the weeds:

Evading pre-plant presentation of soluble nutrients that may be more suitablyused by fast-growing weeds than slow-growing crops, and may even induce weed germination.

– Application of fertilizer close to the rows where it is more keen to be taken by the crop.

– Costly caught organic fertilizer can beused cheap rates at planting or sidedress, counting on mid-season discharge of nutrients from compost or green manures for primary fertility.

Water management :

Efficient water management is crucial to suppressing weeds in an organic farming system. There are a number of strategies that vigilant irrigation management system can help you to inhibit weed population in your crop field.

Pre-germination of weeds :

In pre-germination irrigation system or rainfall, weed seeds tends to germinate just before the main crop is incorporated. The freshly germinated weeds can be destroyed by light flaming. Pre-germination should happen as anearly suitable to the plantation date to confirm that any change in weather conditions do not have a prospect to modify the continuum of weeds in the land.

Planting to moisture :

Another strategy familiar with pre-germination is planting to moisture. After the weeds are destroyed by harvesting, the top 2 to 3 inches of soil are permitted to parch and make a dust mulch. At plantation time the dust mulch is alienated and large-seeded vegetables such as beans or corns can be rooted into the zone of soil moisture. These seeds can germinate, develop and produce fractional covering of the soil surface without additional irrigations that would otherwise give for an initial flush of weeds.

Buried drip irrigation :

Drip tape buried below the surface of the plantation bed can produce moisture to the crop and reduce the quantity of moisture that is accessible to weeds near to the surface. This strategy can provide desirable weed control during dry period if suitably managed.

Mechanical weed control :

Mechanical elimination of weeds is both labour-demanding and time consuming, but is extremely efficient strategies for controlling weeds. The selection of application, timing and rate will be liable on the shape of the crop and the kind and number of weeds. Harvesting includes destruction of weeds or burying newly shed weed seeds below the deepness from which they begin to germinate. It is necessary to evoke that any ecological method to weed control starts and stops in the soil seed bank. The soil seed bank is the stock of weed seeds exists in the soil. Detecting the configuration of the seed bank can assist an organic grower take practical weed management choices. Burial to 1 cm deepness and cutting at the soil surface are the most efficient strategies to manage weed seedlings mechanically.

Mechanical weeders consist of harvesting tools such as harrows, tines, hoes and brush weeders, cutting tools like stimmers and mowers and dual-function tools like thistle-bars. The selection of appliance and the timing and frequency of its application hinges on the morphology of the crop and the weeds. Tools like fixed harrows are more preferable for arable crops, however inter-row brush weeders are believed to be more efficient for horticultural application. The brush weeder is chiefly applied for vegetables like beetroot, carrots, onions, leeks and garlic. The ideal timing for mechanical weed management is guided by the competitiveness of the crop and the developmental stage of the weeds.

Hand hoes, hand-weeding and push hoes are applied when coarse of a single patch of weed is the best efficient

way of inhibiting the weed from increasing. Hand-weeding can also be applied after mechanical inter-row weeding to counter with weeds existed in the crop row.

'Over-the top' harvesting manages very few weeds which are recently germinated, before and few times after plantation. The completearea of the fields is functioned very insubstantial applying flex-tine cultivators provide sufficient weed management without inhibiting plant stand or any damage to the crop.

The hoe-ridger is explicitly targeted to obtain intra-row control in Thistle-bars, sugar-beets are plain blades accustomed to damage perennial weeds with low soil interruption. The brush weeder is mainly applied for inter-row weeding of vegetable crop.

Thermal weed control:

Flamers :

Flamers are valuable for weed suppression. Thermal weed management embroils the application of flaming tools to heap uninterrupted interaction among the flame and the plant (Bowman, 1997). This strategy functions by bursting plant cells when the sap briskly extends in the cells. Occasionally thermal control includes the absolute sweltering of the weeds. Flaming can be applied either before crop arousal to provide the crop a modest benefit. Some how, flaming at this point in the crop harvesting cycle may destroy the crop. Though the primary tools cost may be expensive, flaming for weed management may justify inexpensive than hand weeding.

Propane – fuelled models of flamers are the most generally applied tools. Flaming does not sear weeds into ashes; rather the flame quickly emerges the temperature of the weeds to more than 130 °F. The quickarise in temperature makes the plants cell sap to expand, bursting the cellwalls. For most flaming efficacy, weeds must have lower than two true leaves. Grasses are difficult to destroy by flaming method because the growing point is shielded underground (Crampton,1974). After flaming, weeds that have been destroyed quickly modify from a shiny look to a faded look. Flame weeders may be applied when the soil is verymuch moist for mechanical weeding and there is no soil interruption to enhance further weed arousal.

Flaming can be applied before to crop rise in sluggish-germinating vegetables such as peppers, carrots, and onions. Onions have some lenience to flaming and flame weeding has even effective in both pre and post-crop rise conditions and after uprooting. Transplanted cabbage has some resistance to heat, permitting band flaming to be applied between the crop row. Loss can happen when the treatment is usedin initial period, but the crop generally improves. In a fresh pear orchard, where treatments were initiated on a fresh soil after harvesting, flaming kept weed development in plaid. In a well grown apple orchard, there was inadequate restraint of perennial weeds. Top out comes are achieved under windless situations, because winds can inhibit the heat from touching the focused weeds. The efficacy of flaming is mostly inhibited if moisture from dew or rain is appeared on the plants. The best times to check the flame patterns and regulate the tools are early morning and early evening.

Soil solarization :

Organic growers fumigate their soil by solarization process during summer. Adistinct plastic film is set over an area after it has been dug and compactly coated at the edges. Solarization works when the heat wrecked under the plastic film turnsstrong enough to destroy weed seeds.

Infrared weeders:

Infrared weeders are an additional growth of flame weeding in which the burners warm ceramic or metal surfaces to produce an infrared radiation focused at the target weeds. Some weeders use a mixture of infrared and direct flaming to destroy the weeds. In specific, flame weeders are believed to be more efficientas they produce high temperature. Infrared weeders shield a dense area than those of the norms flame weeder, but may require time to heat up.

Freezing :

Freezing would be usefulif there is an apparent fire risk from flaming. Application of Liquid nitrogen and solid carbondioxide can be done for freezing weeds. Different testing techniques using microwaves, electrocution and irradiation have also been assessed for weed control, but slow working rates, high energy inputs and the safety measures for operators have obstructed further developments. Lasers have been displayed to reduce the growth the *Eichorniacrasispes* (water hyacinth) but did not destroy the weed entirely. Application of UV light for weed control has been patented but rests at an experimental stage.

Biological weed control:

Biological weed control would seem to be the pure resolution for weed management in organic farming.

Allelopathy :

Allelopathy has the direct or indirect chemical impact of a plant on the germination and development of adjoining plants. It is generally referred as an element of biological weed suppression. Both crops and weeds species show this capability. Allelopathic crops consists of barley, rye, buckwheat, oats, sorghum, alfalfa, sunflower, wheat and red clover. Vegetables like horse radish, radish and carrot extract specific strong allelopathic chemicals from their roots. Reports have been suggested that allelochemicals and other natural products and their derivatives could make the core of bioherbicides. Somehow, it is less distinct whether the use of bioherbicides would be adequate to the organic norms.

The allelopathic impact can be applied to a benefit when oats are propagated with a new plantation of alfalfa. Allelopathy from both the oats and the alfalfa will inhibit the plantation from being obstructed with weeds in the first year. Buckwheat is also widely recognised for its specific powerful weed control nature. Plantation of buck wheat on weed difficulties, lands can be made by an efficiente limination strategy. Some growers permit the buck wheat farming for only about six weeks before tillage. This not only control and naturally damages weeds; but also liberate phosphorus and maintains well conditions of soil.

Beneficial organisms:

Few studies have been operated on applying parasites or insects to control weed difficulties. Somehow, this may confirm to be a beneficial control means in the near future. Natural predators that have been effective involve a weevil for the aquatic weed Salvinia which is a rust for skeleton weed and possibly the most recognised caterpillar (*Cactoblastis* sp.) to suppress prickly pear (Whitson, 1992). There is also substantial investigation attempt focused at genetically engineering fungi (myco-herbicides) and bacteria so that they are more efficient at managing particular weeds.

Chemical control :

Chemicals that destroy or inhibit plants by affecting their physiological processes are called herbicides. Afew numbers of herbicides are organically adequate.These consists of contact stuffs like acetic acid, citric acid and sodium nitrate solution stogether with a pre emergentthing, corn gluten. Herbicides may be applied for desirable weed suppression by controlling the timing of use or setting of stuff, or by using variances in the chemical for bearance of the crop as well as the target weed. Weeds that arise before the crop can be destroyed with contact herbicides (acetic acid or vinegar etc.). These herbicides destroy plants that have arose, but have no enduring persuit on those that arose later. Corn gluten is a pre emergent stuff that is used to the soil to control weeds as they tend to germinate. Now-a-days, the efficiency of these organically preferable herbicides is fringe at top.

Conclusion:

There are no plain norms obtainable for weed management in organic farming. When a traditional grower depends on herbicides, which can be used with brief sight to treat a land from a continuing weed invasion, the organic grower requires to fetch lengthy outlook while taking proactive actions to evade crop loss. Cultural and direct methods require to be incorporated in organic agriculture with long term aim to inhibit the emergence of weed-causing crop losses, while limiting costs for weed management.

REFERENCES

Bowman, G. (1997). *Steel in the fields: A farmer's guide to weed management tools.* (Ed.) Beltsville, MD: Sustainable Agriculture Network.

Crampton, B. (1974). *Grass in California.* Berkeley: University of California Press.

Davies, G. and Rosenfeld, A. (2004). Participatory research and learning for organic farming systems. In: *ESRC Transdisciplinary Series: Approaches to Sustainable Farmland Management at Silsoe Research Institute,* 20 April 2004.

Davies, G. and Turner, B. (2004). Organic farmers' perspectives on weed management. In 'Arable weeds and biodiversity' at CSL, 27–28 September 2004. Wellesbourne: The Association of Applied Biologists.

Davies, G. and Turner, R.J. (2004). Systems thinking in organic research: weeds are the symptom. In: *Organic Farming: Science and practice for pro table livestock and cropping.* Proceedings of the BGS/AAB/COR Conference, pp 180–184, at Harper Adams University College, 20–22 April 2004. Ed. A. Hopkins. British Grassland Society.

Davies, G., Turner, R.J., Bond, W. and Gibbon, D. (2005). *Weed management in organic farming systems: a learning approach.* Proceedings BCPC Crop Science and Technology Conference 2005, pp. 715–722. BCPC.

Davies, G., Turner, R.J. and Gibbon, D. (2006). *Knowledge development for weed management in organic farm systems in the UK. In Changing European farming systems for a better future*. New visions for rural areas, pp 304–308. Eds H Langeveld and N Roling. Wageningen Academic Publishers.

Whitson, T. D. (1992). W*eeds of the west.* (ed.) Newark, CA: Western Society of Weed Science.