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Popular Article

Use of the residues left after harvesting of Cole crops as bio fumigants for decreasing the incidence of soil born pest

Ranjana Kumari (senior Research Fellow) Krishi Vigyan Kendra, Mandi, Himachal Pradesh, India

Dr. Shakuntla Rahi (PES Vegetable Science) CSKHPKV Palampur, Himachal Pradesh, India.

Dr. Brij Vanita Thakur Dr. GC Negi COVAS, CSKHPKV Palampur, Himachal Pradesh, India.

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Abstract

In crop production, the threats of soilborne pathogens, disease epidemics, climate change, high cost of chemical (nematicides and fungicides), development of chemical resistance and new disease outbreaks are increasing worldwide. Soil borne pathogen and plant-parasite nematodes difficult to manage once they established in soil. Many chemical fumigants effectively suppress pathogen, but most of the compounds are harmful to the environment. Biofumigants can be an option for disrupting disease and nematode life cycle. The use of Cole and other Brassica crops residues as biofumigants has emerged as an environment friendly alternative to prevention of soil borne pest diseases and chemical soil fumigation treatment.

Keywords: Cole crops, fungicides, nematicides, resistance.

Introduction

Agricultural crops are attacking by different insects, fungi, bacteria, viruses and nematodes. Chemical nematicides and fungicides are considered the most effective method in suppressing these soilborne pathogens population. The chemical nematicides including fumigants such as Ethylene Dibromide & 1,2-Dibromo-3-Chloro propane, Chloropicrin, Metam-sodium, Dazomet, Methyl Bromide and Methyl Iodide whereas non-fumigants nematicides viz., Aldoxycarb, Carbofuran, Oxamyl, Fenamiphos, Cadusafos and Fosthiazate are the widespread which are used in soil fumigation. The fumigant action of these volatile compounds that are released, suppresses the soil-borne pathogens. These synthetic soil fumigants are highly toxic to pests. Soil contains



many beneficial microorganisms which help in increasing the fertility of the soil. These fumigants not only kill the pathogens but also kill these friendly microorganisms. Using synthetic fumigants to destroy soilborne pathogens is a very expensive solution and it also has a lot of side effects on the environment, long-term use of these chemical fumigants changed the soil chemical and microbiological properties on the contrary, using the residues of Cole crops especially cabbage and mustard crops as biofumigants is not only an eco-friendly option, but it can also save the environment from chemical pollution. This method can be used along with other low cost and environment friendly methods in integrated disease control.

Bio fumigation is the method of pest control in agriculture where the gaseous active (volatile) substance which is naturally present fumigant produced by the decomposition of plant material freshly chopped and buried in the field soil and the plant crops used for this purpose is called biofumigants crops.

Cole crops are a group in Brassicaceae that includes varieties of the species Brassica oleracea such as broccoli, cabbage, cauliflower, Brussels sprouts and mustard. The residues of these crops left after harvesting are used as biofumigants for soil treatment in order to prevent the incidences of soil born plant diseases in agriculture. These crops from the Brassicaceae family (e.g. cauliflower, broccoli and mustard) are primarily used due to their high glucosinolate content which is naturally found element in these crops and which are converted into gaseous (volatile) elements called isothiocyanates (ITCs) when the plant tissue breaks down or gets moisture in the field soil. Due to this characteristic of these crops these are also called bio fumigant crops. Bio fumigant crops are producing high levels of compounds called isothiocyanates (ITCs). The ITCs compounds is anti-disease gaseous elements and act as biocidal fumigants that can kill, or suppress, soil borne pathogens and weed seeds, much like as chemical fumigants. These compounds are toxic to soil organisms such as bacteria, fungi and nematodes, but less toxic and persistent in the environment than synthetic fumigants.

Selection of Cole crops residues:

In North India, mustard and cabbage crops are grown in winter and the residues are available in March-April. If these residues are mixed in the field and irrigated in the month of May, then it purifies the soil before sowing of the next crop i.e. in the month of July. Their use is more effective in summer because the leakage from the residues increases as the temperature increases. Quantities of 'glucosinolate' elements are found different in different species of cole crops such as



mustard and cabbage. Of these, mustard and broccoli have the highest content. These crops are grown every year in the hilly areas of Northern India's and the residues of these crops are easily available to the farmers. Naturally, the effect of residues is found to be more in large quantities (10 tons/hectare). The smaller the size of their pieces, the more easily they will mix in the entire surface of the field and the leakage of gaseous element will also be equal. Fresh residues have more impact than dry residues. During flowering, anti-disease elements are found in high quantities in these crops.



Figure.1 Residues left after harvesting of Cole crop (Cabbage & Cauliflower)

Method of application: In Northern India, mustard and cole crops are grown in winter and the remaining of these are available in March-April. If the crop is grown in the same field, then plow it directly in the soil, but if the crop residues mass is coming from grown crop or taken from elsewhere and transported to the field, then soil should be well prepared before the incorporation. During transportation of these organic materials in the field, care must be taken to retain the gases produced from biodegradation, by covering the piles of the bio-fumigant with plastic until the time of application. The crop residue should be distributed or mix uniformly in the entire field and the field should be watered (irrigated) until the soil is saturated. The quantity of residues should be at least 5-10 tons per hectare, but the quantity may also increase. After irrigation cover the soil



surface tightly with a white transparent plastic film or polythene sheet for at least 2 weeks. Remove the polythene sheet after 3-4 weeks and let the gas escape and plant the main crop after 24 hours.

Conclusion

Use of the residues left after harvesting of Cole and Brassica crops as bio fumigants is an environment-friendly alternative to chemical soil treatment and prevention of soil-borne plant diseases. By this method, not only soil born pest diseases are prevented but the environment can also be protected from chemical pollution. This method can also be used along with other low cost and environment friendly methods in integrated disease control.

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