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POTENTIALITY OF SUGARCANE BAGASSE ASH AS A BIOCONTROL AGENT OF SOME SOIL BORNE FUNGAL PATHOGENS

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ABSTRACT:-

Population of soil mycoflora (cfu g^{-1} dry soil) were determined in soils amended with two different dosages -5% and 10% of sugarcane bagasse ash in field condition.The overall population of fungi was reduced due to addition of ash in all sampling intervals. Fusarial propagules in general were reduced in ash amended soils and were detected in very low numbers throughout the incubation period in soils amended with 10g ash kg^{-1} soil. Soil pH correspondingly increased in ash amended soils.

Key Words:- Ash, Amendment, Soil p^H, ***Saccharum officinarum*** L., ***Fusarium oxysporum*** f.sp.***ciceri***, Propagules cfu g^{-1} dry soil.

INTRODUCTION:-

It has been well established that the use of fungicides and other biocides in farming creates many perilous ecological as well as many other problems and very costly. A joint Crop Life America (CLA) and European Crop Protection Association (ECPA) report of Feb 2010 show that the cost of developing and registering new pest and disease prevention product has rocketed from an average of $152 million per product in 1995 to $256 millions for the 2005-2008 periods. That's a 68% increase and a 39% increase from the $184 million cost five years ago. Moreover, after some period, many pesticides do not remain effective due to development of resistance capacity by pathogens against them. For these and some other reasons the scientists have been engaged in the development of non-chemical approaches for pathogen control for several years. One of such cheap, simple, durable and ecofriendly method of biological control of soil borne fungal pathogens is manipulation of soil environment through amendment of soil with plant ashes. It is not a new practice but it has been practicising by Indian farmers since long time for their manural value and fungicidal importance.

Wood ash is highly reactive in soil (Karltun et. al., 2008). Plant ash residues have high mineral content and rich in alkali and alkaline earth metals (Daubenmire, 1968; Hand Book of Agriculture, 1969). Because of the presence of high mineral contents and alkaline nature, amendment of soil with plant ashes has a marked effect on physicochemical properties of soil affecting its p^H, moisture salinity and availability of particular nutrients (Ahlgren and Ahlgren, 1965; Hye and Greenland, 1964; Smith, 1970). The increase in p^H also changes bioavailability of soil nutrients due to p^H dependent soil chemical equilibria (Khanna et al., 1994; Demeyer et. al.2001). Addition of wood ash leads an increase in soil p^H and electrical conductivity and increased concentrations of elements such as the nutrients K, S, Ca, Na, Mg, P, Fe, B, Si (Ohno & Susan Erich, 1990; Demeyer et. al., 2001; Augusto et. al.; 2008).

Hence the application of plant ash residues to soil would be expected to affect the various physicochemical and nutritional statuses of the soil and consequently the survival, growth and multiplication of soil borne fungal pathogens.

In the light of these Studies, an attempt has been done to observe reduction in fungal population due to amendment of Soil with sugarcane bagasse ash in field condition.

MATERIALS AND METHODS:-

The experiments were conducted in 1 m^2 microplots laid out in completely randomized design. All the microplots were artificially infested with inocula of ***Fusarium oxysporum*** f.sp.***ciceri*** that were growing on Sand-maize meal medium in 250 ml. flasks incubated at 25°C for 15 days at the rate of 1% W/W into the unsterilized field soils 15 cm deep.

The ash residues obtained by open air burning of dried sugarcane (***Saccharum officinarum*** L.) bagasse on metal trays were incorporated to soil at the rate of 5% and 10% (W/W). The ***F.oxysporum*** f.sp.***ciceri*** treated microplots in which ash residues were not mixed served as control. All the treatments were taken in five replications. Now the soils of each microplots at a depth of 15 cm were hand mixed carefully to spread the fungal cultures and ash residues uniformly.

Microplots were incubated for 15 days under open air field condition for uniform soil infestation with fungus

Soil Samples from each microplot were collected to estimate the number of fungal propagules at 15 days interval for 45 days. After 15 days, 30 days and 45 days of incubation, the first, second and third sampling was done respectively. From each plot five cores of soil to a depth of 15 cm were sampled and each Soil core was bulked and air-dried. After grinding and sieving 10g of subsamples of soil were used to determine the population Changes in soil fungal communities by dilution plate method on Martin rose bengal agar medium whereas the fusarium propagules were counted on modified Czapek-dox agar medium using soil-plate method (Johnson &

Curl, 1972).

Soil pH was measured on a 1:5 soil-water extract using a glass electrode method.

RESULT AND DISCUSSION:-

The most significant change observed was a significant increase of p^H of ash amended soils. It is clear from Table-1 that the amendment of soils with two different dosages-5.0% & 10.0% (W/W) of ash residues maintained a p^H value ranging from 8.0 to 8.9 and from 9.6 to 9.9 respectively. Thus the soil p^H in ash treated soils was always alkaline ranging from 8.9 to 9.9.

The increase in soil p^H due to ash amendment could be attributed to the general chemical nature of ash. Ash residues are generally dominated by alkali and alkaline earth metals. Wetting of ash results in hydrolysis of the contained basic cations and formation of an alkaline residues which may have a p^H exceeding 12.0 (Raison, 1979). A number of workers (Ahlgren, 1974; Nye & Greenland, 1964; Jalaludin 1969; Smith, 1979) have reported an increase in soil p^H after burning of forest and scrub vegetation and have attributed such increase in soil p^H

The quantitative analyses of soil mycoflora isolated from F. ***Oxysporum*** f.sp ***ciceri*** infested unsterilized field soil amended with sugarcane bagasse ash are shown in Table- 2. The result indicated that the application of plant ash reduced the colony counts of total fungi. Reduction in population of total fungi was more pronounced in soils amended with 10g ash/kg soil.

Table-2 also displayed a decreasing tendency of number of fusarium propagules with increasing concentration of ash added soil. The most significant reduction in number of fusarial propagules has occurred in case of soils treated with 10% W/W ash.

The soil pH has long been recognised as an important characteristic which influences soil microorganisms in several ways. Waksman (1952) reported a definite correlation between p^H and number of fungi and that changes in soil p^H of 1.2 - 1.5 units decreased the number of fungi by 1/2 - 2/3. In a study of Indian soils (p^H 7.7 - 11.0) Mukerji (1966) found that the number of fungi were markedly reduced by increasing alkalinity. Chauhan (1962) found a significant correlation between soil p^H and Fusarium wilt of gram, the percentage of disease intensity increasing with lowering of p^H and decreasing with increase in the same. Saxena and Khare (1988) reported that the mortality percentage of lentil plants infected with ***F. Oxysporum*** f.sp. ***lentis*** increased with increase in soil p^H upto 7.5, after which it declined.

These findings give supports to results obtained in present investigation regarding reduction in colony counts of total fungi and number of fusarial propagules with increasing soil p^H due to amendment of sugarcane bagasse ash in field soil.

Table-1: Changes in P^H of ash amended soil infested with f. oxysporum f. sp ciceri

P^H of Ash treated Soil			
Days of Incubation	Amendment type (gash kg^{-1} soil)		
	A0.0	A5.0	A10.0
15 DAI	6.9	8.9	9.7
30 DAI	7.3	8.5	9.6
45 DAI	6.8	8.0	9.9
Means	7.00	8.47	9.73

Each value is the mean of five replications.

Table-2: Populations of Fungi in Ash Amended Soil infested with F.oxysporum f sp. ciceri

Days of Incubation	Populace of fungi in soil (cfu x 10^3 g^{-1} dry Soil)		
	Amendment Type (gash kg^{-1} dry soil)		
	A0.0	A5.0	A10.0
15 DAI	190.5 (28.7)	168.2 (24.9)	132.5 (19.4)
30 DAI	180.5 (30.8)	165.3 (25.5)	124.4 (17.2)
45 DAI	178.8 (32.3)	158.9 (20.6)	110.7 (14.1)
Means	183.27 (30.60)	164.13 (23.67)	122.53 (16.90)

Cfu = colony forming unit

*** = Average of five replications.**

Figures in parenthesis indicate values of population of fusaria in soil.

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