The Effects of Post-Emergence Herbicides on Soil Microflora and Nitrogen Fixing Bacteria in Pea field

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***Abstract*—** The effects of post emergence herbicides on soil microflora and nitrogen fixing bacteria was studied in pea field. Pea (pisum sativum) was grown and treated with one or a mixture of two of several herbicides 2wks after sowing. Soil samples were collected 2wks after herbicides application. Average number of colony forming units per gram of soil of bacteria ,actinomycetes and fungi were determined. Average number of nodules per plant was obtained at the end of the growing season. The results of the study showed MCPB, Bentazon, MCPB + Fluozifop-p-butyl., Bentazon+Fluozifop-p-butyl, Metribuzin, Flouzifop-p-butyl+Metribuzin, Cycloxydin, and Sethoxydin increased the population of soil fungi, with 4 to 10 times compared with the control. The herbicides used showed no significant effects on nitrogen fixing bacteria. The effects of herbicides on soil bacteria and actinomycetes were different. The study showed the use of herbicides could influence the biological balance of soil microflora, which has an important role in soil fertility and microbial ecosystem.

***Keywords*—**Herbicides, Soil microflora, Nitrogen fixing bacteria.

I. INTRODUCTION

MODERN agriculture depends on herbicides for the control of weeds in crops to increase yield. Herbicides are very important to agriculture but their heavily use may act as pollutants that can effect soils , ground waters ,and environment. Herbicides application shown to influence soil microflora, and can cause changes in microbial community function [3,4]. Herbicides toxicity to soil microorganisms can alter community structure including potential increases in plant or animal pathogens. Soil microflora including rhizobium were found to be effected by the use of herbicides [2,25]. Studies have shown herbicides to have no direct effects on the rhizobium but rather on plant growth [11,20,24].Other research has shown some herbicides may directly affect rhizobium growth [18] rhizobium survival [2] rhizobium recognition of the host plant [9,10] nodule formation [22,23]. legumes such as Field pea is high in protein and has high N. needs that generally are met through a symbiotic relationship with N -fixing Rhizobium species. However ,the amount of nitrogen fixed is influenced by several factors including , soil type, soil fertility , crop species, and variety , water availability and temperature as well as soil and crop management [16,18]. Thus any factor or factors that influence this relationship may have a negative impact on the nitrogen fixing association and consequently the nitrogen supply to the plant. The chemicals that are being used in agriculture may disrupt the microbial communities in the soil and therefore affect the symbiotic relationship between N.Fixing Bacteria and legumes [8]. Soil microorganisms like bacteria ,fungi,algae, protozoe, actinomycetes and some nematodes have a vital role in maintaining the soil productivity .Soil microbial biomass is considered an active nutrient pool to plants. The common use of herbicides may negatively affect N fixation either directly by affecting Rhizobium(2,17,19), 0r indirectly by reducing photosynthate allocation to the nodules for N fixation, or by restricting root growth and hence the number of root sites available for infection [6,14,20, 24].The objectives of the study were to evaluate the effects of post-emergence herbicides on the soil microflora and nitrogen fixing bacteria in pea field in Libya.

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II. MATERIALS AND METHODS

The experiment was conducted at Tajura Experimental Station of The Agriculture Research Center.pea seeds were sown in plots (3x5m) with three replicates in Randomized Complete Block design. Each plot was treated by using a sprayer with one or a mixture of two herbicides, with the doses shown in Table I After seven days of herbicides application soil samples 1-2 kgs were collected from 2-3 spots at 0-20cm depth from each plot and bulked in one new plastic pack.Soil samples were transferred to the laboratory and kept in refrigerator.Soil samples were processed within 1wk. Serial dilution technique was used to isolate soil bacteria , soil fungi ,and actinomycetes. Isolation was done by transferring 0.1ml of a proper dilutuin to each petri dish and spread evenly using sterile glass rod. Three replicates were used. Nutrient agar media was used to isolate soil bacteria, Potato dextrose agar amended with 30 ppm. rose bengal was used for isolation of soil fungi. Actinomycetes were isolated by using glucose asparagine agar media..Incubation for bacteria was at 30 C for 24 hr and for actinomycetes and fungi was at 27-30 C for 3-5 days. To assess the effect of herbicides on nitrogen fixing bacteria three mature plants were collected from each

treatment and washed in running water and number of nodules per plant was counted.The average number of colony forming units per gram of soil of bacteria, fungi , and actinomycetes of three replicates were recorded using colony counter.And the average number of nodules per plant of three replicates were obtained.The data was statistically analyzed.

TABLE I
DOSES TREATMENT

Herbicides	Dose rate Kg/h –a.i
control	–
Hand weeding	–
Fenoxa-prop-p-ethyl	0.5
MCPB	1
Bentazon	1
BCPB+Fluozifop-p-butyl	1.0 + 0.5
Bentazon+ Fluozifop-p-butyl	1.0 +0.5
metribuzin	0.5
Metribuzin+fluozifop- p-butyl	0.5 +0.5
cycloxydin	0.2
Sothoxydin	2.0
L.S.D @5%	

III. THE RESULTS AND DISCUSSION

The results of the study showed that all herbicides used increased the population of soil fungi (Fig 1) . Fenoxa-prop-p-ethyl increased the population of soil fungi by 5 folds ,and cycloxydin and MCPB + Fluozifop-p-butyl increased the population by 11 folds compared with the control and hand weeding treatments. Soil bacteria was reduced by all herbicides used (Fig. 2) . Actinomyctes was increased (Fig. 3) by MCPB,Bentazon , MCPB+Fluozifop-p-butyl , Metribuzin , Fluozifop-p-butyl +Metribuzin and Sethoxydin , and no significant effects was shown by the other treatments. All herbicides showed no significant effects on the number of nodules per plant (Fig. 4). The results of the study showed similar findings with other studies .Herbicides have been shown to have different effects on soil microflora and nitrogen fixing bacteria in pea fields and legume plants (3,5,15,16) Herbicides found to stimulate fungal growth(1, 2) . The lack of inhibitory effect of herbicides on nodulation obtained could be due to their rapid inactivation in soil or its rapid translocation along with photosynthate, to distant metabolic sink(7).Other studies have shown no direct effects on the rhizobium but rather on plant growth (6, 11,20,24). MCPB,Bentazon, and metribuzin were found to have no negative effects on nodule biomass when used with recommended doses [12, 20, 24].. And as found in our experiment and other studies, herbicides could have inhibitory effects on soil microorganisms ,but generally the microbial populations react by increasing their biomass and activity [21]. Herbicides have been shown to effect plant growth and have a determinantal effect on soil microorganisms growth and metablism [21,25]. Herbicides could have different effects on soil microflora which could influence the microbial balance of soil which has a vital role on soil fertility and crop yield . More studies should continue to assess the effects of herbicides on soil microflora and nitrogen fixing bacteria on different legume crops in Libya.

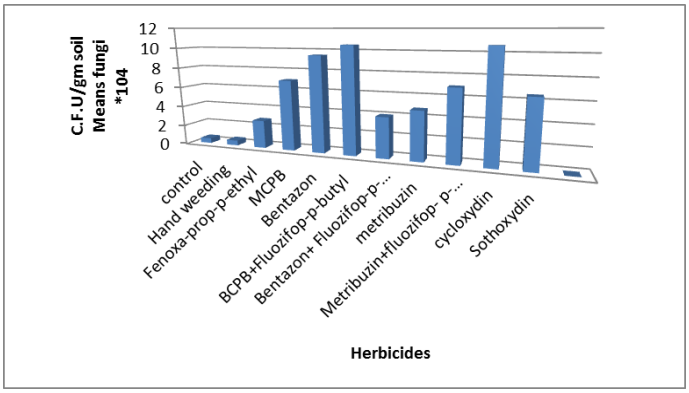

Fig. 1 The effect of herbicides on soil fungi

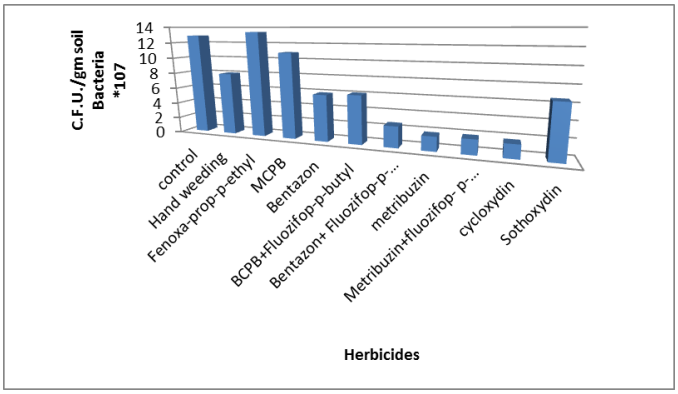

Fig. 2 The effect of herbicides on soil bacteria

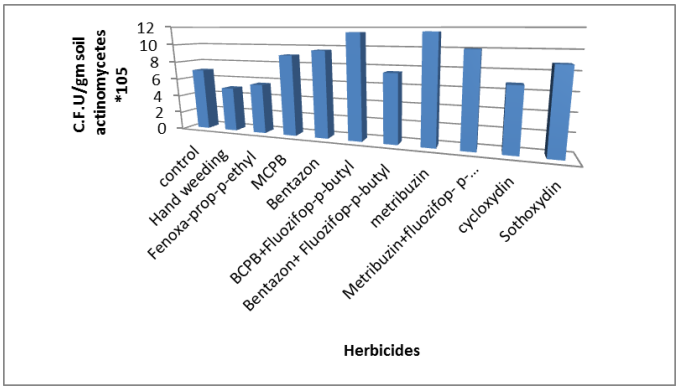

Fig. 3 The effect of herbicides on actinomycetes

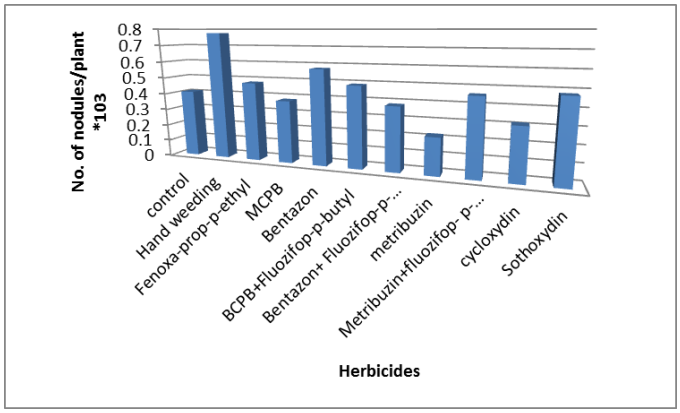

Fig. 4 The effect of herbicides on N_fixing bacteria

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