BIOCHAR, FYM AND NITROGEN INCREASES WEED INFESTATION IN WHEAT

Muhammad Arif[1]*, Kawsar Ali[1], M. Sirajul Haq[1] and Zahid Khan[2]

ABSTRACT

Weeds being serious concern to crop production are directly affected by nutrient sources and amount of available nutrients in the soil. The aim of the present study was to investigate the effect of biochar (BC), Farmyard manure (FYM) and nitrogen levels on the weed infestation in wheat crop. The experiment with three replications and 12 treatments combinations was conducted during winter 2012-13 at New Developmental Farm of the University of Agriculture, Peshawar. A control treatment was included in the experiment. Biochar at the rate of 0, 25 and 50 tons ha^{-1} was applied to the field a year ago. Two levels of Nitrogen (60 and 120 kg ha^{-1}) and two levels of FYM (5 and 10 tons ha^{-1}) were applied to the wheat during the experimental year. FYM significantly affected weed density 35 and 70 days after sowing (DAS), weed fresh and dry biomass were higher at higher level of FYM as compared to low level of FYM. Nitrogen and biochar application significantly affected weeds fresh and dry biomass and were higher in plots treated with 120 kg N ha^{-1} and 50 tons BC ha^{-1} as compared to 60 kg N ha^{-1} and no biochar treated plots, respectively. It is concluded from the above findings that fertilized plots resulted in higher weed density and fresh and dry biomass due to availability of nutrients throughout the growing season.

Key words: Wheat, Biocahr, FYM, Nitrogen and weeds density

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INTRODUCTION

Weeds control is one of the most important factors for sustainable crop production. Understanding and predicting weeds control and nutrient management techniques are fundamentals to many aspects of crop production such as herbicides, fertilizer and irrigation applications (Feldman *et al*., 1998). Weeds control is always

[1]Dept. of Agronomy, the University of Agriculture, Peshawar, Pakistan
[2]Dept. of Pharmacy, Federal Urdu University, Karachi, Pakistan
*Corresponding author's email: marifkhan75@yahoo.com

a serious concern in crop production (Donovan *et al*., 2011). In wheat production, weeds are considered as one of the major factors of low yield. The losses caused by weeds have been estimated too much higher than those caused by insects, pests and disease in wheat. Generally, wheat yield is reduced by 25% to 30% and in some cases up to 50 % due to weeds infestation (Norsworthy *et al*., 2004). Timely weeds control in wheat is essential as it reduces profitability of wheat production system. Weeds compete with crop plant for space, light, air, moisture and nutrients which in turn reduces yield of crop (Iqtidar *et al*., 2008).

The basic nutrient requirements of all crops and weeds are the same, but they respond to nutrient availability in different manner (Blackshaw *et al*., 2000). Insuring nutrients availability to crops generally means making nutrients available to weeds (Donovan *et al*., 2001). The variation in weeds and crops responses to soil productivity and nutrients sources demands the need for better understanding of interactions between management practices and nutrient sources (Liebman and Davis, 2000). In addition, the level of soil fertility determines the relative competitiveness between the crop and weeds (Dada and Fayinminnu, 2010). At higher mineral nitrogen fertilization weeds like wild oat are generally more competitive than crops, however; appropriate nutrient sources and management decisions can have a significant influence on weeds in crop (Donovan *et al*., 2001). Understanding this relationship can help wheat growers attain measures on how to avoid the critical period of weed competition with crops and various cultural management practices (Davis *et al*., 2002).

Wheat yield potential is commonly limited throughout the world mainly because of limited N availability and weed interference. The interaction of nitrogen fertilization and weed infestation is complex and is further complicated by soil and climatic variability (Ruf, 2007). Furthermore, the effects of interactions of nitrogen sources and weed have not been adequately addressed. Manure has been reported as a potentially important source of weed seeds (Pleasant and Schlather, 1994; Miyazawa *et al*., 2004) but reports on the subsequent weed infestation in fields vary from no or little impact (Menalled *et al*., 2005;) to significant increase (Miyazawa *et al*., 2004). Organic manures acts as store house of various weeds seed however, the magnitude of the weed seed content of organic manure mainly depends largely on the organic manure origin.

Biochar has been shown to greatly reduce weed seed viability and germiability (Major *et al*., 2005; Arif *et al.*, 2012). Researchers have found that biochar can affect germination and seedlings establishment of crops such as ryegrass, mug bean and subterranean clover (Solaiman *et al*. 2011). Currently there is no information about the effect that biochar might have on weed populations. It is hypothesized that weed seed germination could be affected by biochar addition to the soil, and that different weed species would show different responses to these soil amendments. Therefore this study attempts to find out the effects of rates of organic sources of nutrients (biochar and farm yard manure) and nitrogen on weed infestation in wheat crop.

MATERIALS AND METHODS

In order to investigate the effect of biochar (BC) and FYM and N application on weeds infestation, an experiment was conducted at New Developmental Farm of the University of Agriculture, Peshawar during winter 2012. The study was consisted of three levels of biochar (0, 5 and 10 tons ha^{-1}), two levels of farmyard manure (FYM) (5 and 10 tons ha^{-1}) and two levels of fertilizer-N (60 and 120 kg ha^{-1}) along with a control treatment. Biochar was applied to previously maize crop and FYM was applied at the time of wheat sowing. Half of the fertilizer-N was applied at sowing and remaining half at tillering stage of the test wheat crop. Phosphorus was applied at the rate of 90 kg ha^{-1} as a basal dose. Urea and SSP were used as sources of N and P, respectively. Data were recorded on weed density 35 and 70 days after sowing (DAS), fresh and dry weed biomass 70 DAS. Weed density was recorded at 35 and 70 DAS from three randomly selected places in each plot with the help of quadrat and was averaged to get weeds density m^{-2}. Similarly, fresh and dry biomass of the samples were recorded 70 DAS to get weeds fresh and dry biomass.

Statistical analysis

Data collected were analyzed statistically according to the procedure relevant to RCB design. Upon significant F-Test, least significance difference (LSD) test was used for mean comparisons to identify the significance among the treatment means (Jan *et al*., 2009).

RESULTS AND DISCUSSION

Weeds density 35 and 70 DAS

Weed density 35 and 70 days after sowing (DAS) was significantly affected by FYM application. Similarly, BC and N application to wheat crop significantly affected weeds density 70 DAS while did not induce significant variation in weed density 35 DAS (Table 1). All interactions were found non significant. Higher level of FYM resulted in more number of weeds at 35 and 70 days after sowing as compared to lower level of FYM. Biochar application at the rate of 25 tons ha^{-1} and N application at the rate of 120 kg ha^{-1} resulted in higher weed density at 70 DAS as compared to no BC and 60 kg N ha^{-1}, respectively.

Weeds fresh weight (unit?)

Biochar, FYM and N significantly affected weeds fresh biomass both at 35 and 70 DAS (Table 2). All interactions were found non significant. Higher levels of biochar, FYM and N resulted in higher weeds fresh biomass. Biochar application at the rate of 50 tons ha^{-1}, FYM at the rate of 10 tons ha^{-1} and N at the rate of 120 kg ha^{-1} produced higher weeds fresh biomass at 35 and 70 DAS as compared to their lower levels.

Weeds dry weight (unit?)

Biochar, FYM and N significantly affected weeds dry biomass at 35 and 70 DAS (Table 3). Like weeds fresh biomass, higher levels of biochar, FYM and N also produced greater weeds dry biomass as compared to their lower levels. Biochar application at the rate of 50 tons ha^{-1} produced more weed dry biomass at 35 and 70 DAS followed by BC application at the rate of 25 tons ha^{-1} whereas no BC treated plots resulted in lower weed dry biomass. Nitrogen application at the rate of 120 kg ha^{-1} and FYM at the rate of 10 ton ha^{-1} resulted in more dry biomass of weeds at 35 and 70 DAS as compared to their lower levels.

The superiority of farmyard manure in terms of enhancing weeds population could be explained from the fact that FYM usually contains seed of indigenous weed species and also essential nutrients required for rapid weeds growth. Similar results are reported by Ali *et al*. (2011) who found higher weeds density in FYM and N amended plots. Similar results are also reported by Jama *et al*. (1997) who stated that application of organic manures resulted in higher weeds biomass and weeds density. Weeds density 35 days after sowing was higher in plots where biochar was applied at the rate of 25 ton ha^{-1}. The weeds had a competitive advantage of absorbing more nutrients from the soil than the crop there by growing better than the crop which may have supplied to the crop and weeds in the soil by the residual biochar in the soil, (Major *et al*., 2005). However, in treatments with 50 ton $ha^{-1}$of BC did not favour weeds to produce a higher population over the crop and hence lower number of weed were counted in these plots. Application of higher dose of biochar may have decreased the amount of available nitrogen to weeds due to high C:N ratio and immobilization properties of biochar (Lehman *et al*., 2007) which resulted in poor population of weeds. As FYM level was increased from 5 to 10 ton ha^{-1} significant increase in weeds population was observed. It could be attributed to the positive impact of FYM on soil water holding capacity, bulk density and nutrient availability throughout the weeds growing periods. Similar results are reported by Ali *et al*. (2011) who concluded that higher level of FYM and N application significantly improved weeds density and fresh and dry biomass. On the other hand, lower availability of plant nutrients in control plots resulted in lower fresh and dry biomass. Many works have demonstrated that farmyard manure favor weeds population through improvement of soil water holding capacity, physical and chemical conditions, and greater availability of plant nutrients (Garcia-Martin *et al* 2007; Olesen *et al*., 2009).

CONCLUSION

It is concluded that FYM improved weed density and their fresh and dry biomass. Biochar and N also improved weed fresh and dry biomass. It is therefore suggested that soil amendments may be carefully planned to avoid weed infestation in wheat crop.

Table-1. Weeds density m^{-2} at 35 and 70 days after sowing in wheat as affected by biochar, FYM and nitrogen levels.

Biochar (ton ha^{-1})	Weed density (m^{-2} 35 DAS)	Weed density (m^{-2} 70 DAS)
0	103	136
25	123	141
50	100	135
L.S.D	Ns	Ns
FYM (ton ha^{-1})		
5	91	129
10	126	145
Significance Level	*	*
Nitrogen (kg ha^{-1})		
60	115	135
120	102	140
Significance Level	Ns	Ns
Interactions		
BC x N	Ns	Ns
BC x FYM	Ns	Ns
N x FYM	Ns	Ns
BC x N x FYM	Ns	Ns

Means of the same category followed by different letters are significantly different from one another at 5% and 1% level of probability.
*=Significant at 5 % level of probability, respectively. Ns = non significant

Table-2. Weeds fresh and dry biomass (kg ha^{-1}) 35 DAS as affected by biochar, FYM and nitrogen levels.

Biochar (ton ha^{-1})	Weed fresh biomass (kg ha^{-1}) 35 DAS	Weed fresh biomass (kg ha^{-1}) 70 DAS
0	373 b	472 c
25	393 a	573 b
50	386 a	595 c
L.S.D	8.5	8.6
FYM (ton ha^{-1})		
5	378	541
10	389	552
Significance Level	*	*
Nitrogen (kg ha^{-1})		
60	373	536
120	393	557
Significance Level	*	*
Interactions		
BC x N	*	*
BC x FYM	Ns	Ns
N x FYM	Ns	Ns
BC x N x FYM	Ns	Ns

Means of the same category followed by different latter are significantly different from one another at 5% and 1% level of probability.
* = Significant at 5 % level of probability, respectively. Ns = non significant

Table-3. Weed fresh and dry biomass at 70 DAS as affected by biochar, FYM and nitrogen levels

Biochar (ton ha^{-1})	Weed dry biomass (kg ha^{-1}) 35 DAS	Weed dry biomass (kg ha^{-1}) 70 DAS
0	109 c	131 c
25	122 b	184 b
50	125 a	212 a
L.S.D	2.6	2.8
FYM (ton ha^{-1})		
5	117	175
10	120	178
Significance Level	*	*
Nitrogen (kg ha^{-1})		
60	115	173
120	122	179

Significance Level	*	*
Interactions		
BC x N	Ns	Ns
BC x FYM	Ns	Ns
N x FYM	Ns	Ns
BC x N x FYM	Ns	Ns

Means of the same category followed by different latter are significantly different from one another at 5% and 1% level of probability.
* = Significant at 5 % level of probability, respectively.
ns = non significant

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