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Determination And Evaluation Of The Effect Of Different Doses Of Humic Acid On The Growth And Yield Of Wheat (Triticum Aestivum L.)

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Abstract: *For the determination of effect of different doses of humic acid on yield of wheat (Triticum aestivum L.)) crop an experiment was carried out at adaptive research farm Sheikhupura, Punjab, Pakistan during the Rabi season of 2011-2012 and 2012-2013. The experiment was conducted in simple randomized complete block design (RCBD) and repeated thrice. The plot has an area of 21 ft*34 ft during 2011-2012 and 22 ft*32 ft during 2012-2013. The row to row distance was 22.5 cm and seed rate 100 kg per hectare. Humic acid was applied at time of sowing @10 kg, 15 kg, 20 kg and 25 kg per hectare. . The wheat crop (cv. Faisalabad- 2008) was drilled on 3 December during 2011-2012 and on 8 November during 2012-2013. The NPK fertilizer was used at the rate of 60-120-67 kg NPK per hectare (recommended). Higher number of productive tillers m^{-2} (260), 1000-grain wt. (35.6 g) and grain yield (3233 kg ha^{-1}) with humic acid @ 10, 15, 20 and 25 kg ha^{-1} as compare to 205, 33.5 g and 2433 kg ha^{-1} with 0 kg humic acid ha^{-1} respectively during the 2011-2012 year. Similarly no. of productive tillers m^{-2} (230), 1000-grain wt. (33.5) and grain yield (3300 kg ha^{-1}) with humic acid @ 10, 15, 20 and 25 kg ha^{-1} as compare to 202, 32.1g and 2750 kg ha^{-1} with 0 kg humic acid respectively during the 2012-2013 year. As the results showed, it is recommended that humic acid may be applied @ 25 kg $ha^{-1}$for obtaining higher yield in wheat in the agro-climatic conditions of Sheikhupura, Punjab, Pakistan.*

Keywords: *grain yield,humicAcid, NPK fertilizer, productive tillers,wheat (Triticum aestivum L.),*

I. Introduction

Wheat (Triticum aestivum L.)is a major cereal crop belonging to family Gramineae. Pakistan occupies 8th position in wheat production. The area under wheat cultivation is 8666 hectares with production 2714 kg per hectare which is much lower than the potential of our varieties. Wheat contributes 12.5% to value added and 2.6 % of GDP in Pakistan (Agriculture Statistics of Pakistan 2012). Due to the increased pressure of population and lessen productivity of agricultural land enforces the farmer to follow intensive cropping system (Saleem et al 1986). Wheat is a chief constituent of many foods items like bread, pastries, cakes, biscuits, cookies and many other alcoholic beverages. Wheat contains about 51.8 g Carbohydrates , 23.15 g of proteins, 9.72 g of fats, 13.301 mg of manganese and 13.2 g of dietary fiber per hundred grams and.It also contains a number of different micro and macro nutrients as well as vitamins in trace amount (USDA, 2006).

Due to the decomposition of organic materials humic substances are produced. (Stott and Martin, 1990). Humic Acid can be integrated into the soils in the form of manure, it improves the physical properties of the soil. Humic materials are naturally present in soils, water structures, and in organically based support systems for human life like those which are being determined by Advanced Life Support (ALS) program of NASA. In these systems higher plants are used for production of food, recovery of oxygen and also for the treatment of water.

Aqueous compounds are formed when humic acid combines with micronutrients(Aiken et al., 1985). Residues of animals and plants are the major part of the organic matter of soil. When the organic matter is decomposed, primary organic substances are produced. There is no specific chemical formula for organic matter of soil because it is dynamic in nature.

Almost the entire humic materials are contained non-biochemical compounds. These compounds are very attractive to water, unstructured, dark in colour, liquor or powder and have resistance against decomposition by chemical and biological means (Mackowiaket al., 2001; Adaniet al., 2006). Humic acid and fulvic acids are the primary constituents of organic matter of soil and these materials are called humin (Schnitzer 1982; Andriesse 1988). Humic acid is very economical and less costly organic product which enhances the fertility status of soils. Humic acid increases availability of other nutrients and therefore increase growth and yield of crops (Doran et al., 2003).

Several studies indicated that the yield of crops was much higher when we use organic fertilizers in combination with synthetic fertilizer as compared to others where only synthetic fertilizer was use (Sarwar et al., 2007; Sarwar et al., 2008). Humic acid (HA) is present in nature as polymeric organic substance. It has been

studied that it can be used to increase growth and with the use of it nutrient availability can be increased (Sharif et al., 2002).

This study was planned to verify the growth and yield of wheat crop that is affected by the application of different doses of humic acid under agro-ecological conditions of Sheikhupura.

II. Materials And Methods

For the assessment of the effect of different levels of humic acid (HA) to get higher yields of wheat crop (Triticum aestivum), an experiment wasconducted at Adaptive Research Farm Sheikhupura, Punjab, Pakistan during Rabi season 2011-12 and 2012-2013. The experiment was conducted using randomized complete block design (RCBD). Five different doses of humic acid were used for five treatments viz. Control (T1) where only NPK fertilizer at recommended doses was used, (T2) humic acid @ 10 kg, (T3) humic acid @ 15kg, (T4) humic acid @ 20kg and (T5) humic acid @25kg per hectare. The experiment was replicated thrice with a net plot size of 21 ft*34 ft during 2011-2012 and 22 ft*32 ft during 2012-2013. The wheat crop (cv. Faisalabad- 2008) was drilled on 3 December during 2011-2012 and on 8 November during 2012-2013. The NPK fertilizer was used at the rate of 60-120-67 kg NPK per hectare (recommended). The row to row distance 22.5 cm was maintained and seed rate per hectare was 100 kg. The humic acid was applied at the time of sowing of wheat crop. All cultural operations kept same for all the treatments (recommended). Number of plants emerged and number of productive tillers per unit area were determined from an area of one square meter which was selected randomly from three different points in each plot. Plant height in centimeters was noted from one square meter area from each plot. The 1000-grain weight and yield on per hectare bases was recorded by weighing three samples from each plot. Mean values were taken for all the parameters and used for statistical analysis by Steel and Torrie.

III. Results And Discussion

Humic acid is very economical product which increases the fertility status of soil. Humic acid increase nutrient availability by improving aeration of soil, water holding capacity and lower the pH of the soil. These provide conditions which are favorable to plant growth and ultimately increase yield of crop. The results of this study showed that the application of humic acid affect the no. of emerged plants/m^2, number of productive tillers/m^2, plant height (cm), 1000-grain weight of grains and grain yield (kg/ha) considerably and have an edging over control.

1.1. Number of emerged plants/m^2

The data (Table) showed that there were insignificant variations amongst the treatments regarding the number of plants emerged per square meter during the period of both years. Although the number of plants emerged from an area of one square meter ranged from 133 to 153.

1.2. Number of productive tillers/m^2

According to the data there were significant differences among the treatments. The data showed that the plants which were grown in soil containing humic acid produce more number of tillers as compare to control in which humic acid was not applied during the both years. During 2011-2012 the maximum number of tillers was produced by T5 i.e. humic acid was used @ 25 kg per hectare (260) and T4 i.e. humic acid was applied @20 kg per hectare (249). Although the number of productive tillers produced by T3 i.e. 15 kg humic acid per hectare (241) and T2 i.e. 10 kg humic acid per hectare (228). The minimum number of tillers was observed in T1 i.e. control (205) where humic acid was not applied.

A similar trend of number of productive tillers was observed during 2012-2013. Maximum number of tillers was observed in T5 treatment (230). Although it was nearly similar to T4 (228) and T3 (213). The minimum number of productive tillers (202) was found in T1 where humic acid was not applied.

1.3. Plant height

The data (Table) showed that there were non-significant variations among the treatments regarding the height of plants. The samples were collected from an area of one square meter for measuring height of plants during the both years. However the height of plants ranged from 90 cm to 94 cm.

1.4. 1000-grain weight

The data showed that there were significant differences among treatments for 1000-grain weight during both years. During 2011-2012 the maximum 1000-grain weight (35.6 g) was found in T4 which is similar to T5 (35.3 g). T5 showed similarity with T3 and T2. The minimum 1000-grain weight (33.5 g) was observed in T1 i.e. humic acid was not applied to soil.

1.5. Grain yield

Data (Table) demonstrated that there were significant differences among treatment for grain yield during both years. Maximum yield was calculated during 2011-2012 was in T5 (3233 kg/ha) followed by T4 (3033 kg/ha). T3 i.e. 15 kg/ha humic acid produced higher yield (2800 kg/ha) than T2 i.e. 10 kg/ha humic acid produce (2660 kg/ha). In control treatment there was much lower yield i.e. 2433 kg/ha as compared to those in which humic acid was applied. Similarly in 2012-2013 higher yield was observed in T5 treatment (3300 kg/ha) followed by T4 treatment (3166 kg/ha). Yield in these treatments was much higher than T3 and T2. Minimum yield was recorded in T1 treatment (2750 kg/ha) which is control and there was no application of humic acid.

Table: Number of emerged plants/m^2, No. of productive tillers, Plant height (cm), 1000 grain weight (g) and grain yield of wheat as influenced by humic acid.

Treatments	No. of emerged plants/m2		No. of productive tillers/m2	
	2011-2012	2012-2013	2011-2012	2012-2013
T1= Control	150.00	139.00	205.00	202.00
T2= Humic acid @10kg/ha	145.00	138.00	228.00	213.00
T3 = Humic acid @15kg/ha	149.00	133.00	241.00	221.00
T4= Humic acid @20kg/ha	153.00	137.00	249.00	228.00
T5= Humic acid @25kg/ha	149.00	142.00	260.00230.00	
T1= Control	**Plant height (cm)**		**1000 grain wt. (g)**	
T2= Humic acid @10kg/ha	2011-2012	2012-2013	2011-2012	2012-2013
T3 = Humic acid @15kg/ha	92.3091.00		33.5	32.1
T4= Humic acid @20kg/ha	92.7091.70		35.0	33.3
T5= Humic acid @25kg/ha	95.70 92.70		35.3	33.3
	90.3094.30		35.6	33.2
	94.7091.30		35.3	33.5
T1= Control	**Grain yield (kg/ha)**			
T2= Humic acid @10kg/ha	2011-2012	2012-2013		
T3 = Humic acid @15kg/ha	2433	2750		
T4= Humic acid @20kg/ha	2660	2917		
T5= Humic acid @25kg/ha	2800	3050		
	3033	3166		
	3233	3300		

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