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Effect of Fertility Levels and Cow Urine Foliar Spray on Growth and Yield of Wheat

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A B S T R A C T

A field experiment was conducted in the *rabi* season on Integrated Farming System at BHU, Varanasi to evaluate the effect of different level of fertility and cow urine foliar spray on growth, yield and yield attributes of wheat (Var-HUW 234). The grain yield and straw yield of wheat varied significantly under varying levels of fertility and cow urine foliar sprays. The experiment was conducted under the split plot design with three replications. However, the response of fertility levels (RDF = 120-60-60-25 kg ha^{-1} of NPKZn levels) to the improvement of grain and straw yield was positively correlated and the same was also true in case of grain and straw yield increment with the spray of cow urine. The Cow urine foliar sprays (four) were done at 20 days interval from 30 DAS to 90 DAS to study the effect on growth and yield of wheat. It was reported that application of 80% and 100% RDF, respectively recorded 10.37% and 20.46% higher grain yield over 60% RDF. Moreover, application of 50%, 75% and 100% cow urine spray recorded 2.69%, 18.01% and 27.21% higher grain yield, respectively over control.

Introduction

Farming system (FS) has been generally mentioned everywhere as a combined effort of crop and livestocks (cattle). Wheat is one of the most important cereal crop in the world. In India, wheat is the second most important staple cultivated food after rice and consumed by nearly 65% of the Indian population (Mishra *et al.*, 2005) and rank first in dietary shares in northern India represented by Gangetic plains (Joshi *et al.*, 2007). Presently, wheat accounts for 96.64 MT (2016-17). But, the growth in production has led to India now being the world's second largest producer of wheat. However, the increasing imbalanced and indiscriminate use of chemical fertilizers leads to deterioration of soil health and fertility. So, integrated nutrient management (INM) is the most appropriate and adoptable practice in which both organic and inorganic sources of nutrients is included, with an objective to increase crop production without deterioration of soil fertility. The concept of organic farming has been gaining momentum with the use of different manures with the liquid organic manures can help to maintain optimum crop yield by maintaining the fertility status (Arun Kumar *et al.*, 2014). The integrated use of inorganic fertilizers with the

liquid organic manures (cow urine) can help to maintain optimum crop yield by maintaining fertility status of the soil. Cow urine contains 95% water, 2.5% urea, and 2.5% minerals, salts, hormones and enzymes. It also contains essential minerals like iron, calcium, phosphorus, carbonic acid, potash, nitrogen, ammonia, manganese, sulphur, phosphates and potassium, urea, uric acid, amino acids, enzymes, cytokinin, lactose etc. (Bhadauria, 2002). Research shows that only 20% of nitrogenous materials consumed by cattle are absorbed and 80% is excreted in urine and dung. The beneficial effect of cow urine application has been reported on several crops such as on mustard (Gupta, 2005, Meena *et al.,* 2013 and Pradhan *et al.,* 2016), Maize (Devakumar *et al.,* 2014), and Sweet corn (Pande *et al.,* 2015), and on vegetables such as on Watermelon (Burubhai and Eribo, 2012), Chilli (Keduka *et al.,* 2014) and Lablab bean (Maheshari *et al.,* 2017). With these facts, the present study entitled the effect of fertility levels and cow urine foliar spray on growth, yield and yield attributes of wheat.

Materials and Methods

A study was conducted at the Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during *rabi* seasons of 2015-16 on the wheat variety named HUW-234. The experiment was laid out in split plot design with three main plots and four sub plots and that was replicated thrice. The main plot factors are F_1- 60% of recommended dose of fertilizer (120-60-60-25 kg ha^{-1} of N, P_2O_5, K_2O and $ZnSO_4$), F_2- 80% RDF and F_3- 100% RDF, respectively. The subplots were U_0- water spray, U_1- 50% cow urine spray, U_2- 75% cow urine spray and U_3- 100% cow urine spray. The half dose of N and full doses of P_2O_5 and K_2O was applied as basal dose and remaining one-fourth of N was applied as first top dressing and second top dressing at 40 DAS and 60 DAS respectively. Four foliar sprays of cow urine at 30, 50, 70 and 90 DAS were applied to observe the effect of cow urine on growth, yield and yield attributes of wheat. The seed sowing was done with the spacing of 22.5 cm × not maintained. The observations were recorded on the various aspects pertaining to growth parameters *viz*. plant height, LAI and yield attributes such as number of ear m^{-2}, number of grain ear^{-1}, Test weight (g), Grain yield and straw yield etc.

Results and Discussion

Growth

Plant height, LAI of wheat plant varied markedly due to different soil fertility levels and cow urine as foliar sprays in different concentrations. Taller plants and higher tiller numbers at all the stages of plant growth were found in highest fertility levels and maximum cow urine concentration as foliar sprays. In 2015 data, the fertilizer applied at 100% RDF produced significantly taller plants than 60% RDF at all the growth stages. It was evident that wheat plants supplied with adequate amount of major nutrients (100% RDF) produced more leaves and prolific roots for supply of nutrients and water and hence brought about greater accumulation of photosynthates, yielding more height, LAI (70 DAS) in all the growth stages (Table 1).

The growth attributing characters progressed presumably because of better supply of nitrogen and other major, secondary and micro-nutrient at higher rate of urine application. The different enzymes and hormones present in cow urine are also lead to better growth of plant (Vahanka *et al.,* 2010).

Yield attributes

Yield attributes such as ears m^{-2}, grains ear^{-1}, 1000-grain weight, and improved remarkably due to increase fertility levels from 60 to 100% RDF in the experimental year, 2015-16.

Table.1 Effect of fertility levels and cow urine spray (Four foliar spray) on growth of wheat

Growth parameters of Wheat				
Treatments	Plant height (cm)			Leaf Area Index
Fertility Levels	40 DAS	70 DAS	At Harvest	At 70 DAS
60% RDF	32.31	93.73	92.02	3.37
80% RDF	33.00	97.19	93.52	3.49
100% RDF	34.15	98.19	99.08	3.76
SEm±	0.34	0.85	0.88	0.03
CD at 5%	**1.33**	**3.33**	**3.45**	**0.13**
Cow Urine spray				
Control	32.806	94.81	92.94	3.32
50% CU	33.056	95.22	93.53	3.49
75% CU	33.389	96.08	94.83	3.56
100% CU	33.361	99.36	98.19	3.80
SEm±	0.606	1.12	1.26	0.04
CD at 5%	**NS**	**3.34**	**3.73**	**0.11**

Table.2 Effect of fertility levels and cow urine spray (Four foliar spray) on yield attributes of wheat

		Yield attributes of Wheat		
Treatments	Ear numbers per square meter	Grain numbers per ear		Test weight (g)
Fertility Levels				
60% RDF	290.75	35.28		37.32
80% RDF	296.42	37.52		37.73
100% RDF	314.75	39.51		40.28
SEm±	3.97	0.72		0.49
CD at 5%	**15.61**	**2.84**		**1.94**
Cow Urine spray				
Control	284.33	92.9		37.48
50% CU	297.11	93.5		38.04
75% CU	305.44	94.8		38.71
100% CU	315.67	98.2		39.53
SEm±	5.61	1.26		0.48
CD at 5%	**16.67**	**3.73**		**1.42**

Table.3 Effect of fertility levels and cow urine spray (Four foliar spray) on yield of wheat

		Yield attributes of Wheat	
Treatments	Grain Yield (q/ha)	Straw Yield (q/ha)	Harvest Index (%)
Fertility Levels			
60% RDF	27.46	40.48	40.41
80% RDF	30.31	41.50	42.20
100% RDF	33.08	45.16	42.28
SEm±	1.05	0.64	0.80
CD at 5%	**4.14**	**2.53**	**2.40**
Cow Urine spray			
Control	27.04	40.54	40.01
50% CU	27.77	41.50	40.08
75% CU	31.93	43.11	42.55
100% CU	34.40	44.37	43.67
SEm±	1.19	0.86	0.90
CD at 5%	**3.54**	**2.56**	**2.70**

Dig: 100% fertility levels and 100% cow urine treated experimental plot

The highest values of ears m^{-2}, grains ear^{-1}, 1000-grain weight, and in 2015 were recorded with 100% RDF. So, 100% RDF was distinctly superior to other fertility levels. The increased grain yield at higher fertility level may be attributed to the increased vegetative growth and better availability of nutrients during growth period, more synthesis of carbohydrates and their translocation (Muthuswamy *et al.,* 1990 and Minhas and Sood, 1994, Mondal *et al.,* (2013), Singh *et al.,* (2014) and Srivastava *et al.,* (2014). Consequently, the highest values of ears m^{-2}, grains ear^{-1}, 1000-grain weight, and during 2015 were recorded with 100% foliar spray of cow urine (Table 2).

Yield

Grain yield in the year of experimentation (2015 - 2016) showed significant variation due to 100% fertility levels and 100% cow urine as foliar spray. It was reported that application of 80% and 100% RDF, respectively recorded 10.37% and 20.46% higher grain yield over 60% RDF. Moreover, application of 50%, 75% and 100% cow urine spray recorded 2.69%, 18.01% and 27.21% higher grain yield, respectively over control (Table 3).

The highest grain yield was noticed at 100% RDF and also at 100% foliar spray of cow urine. It was noticed that grain yield of rice was improved with increasing concentration of cow urine from control to 100% in the year (2015 - 2016). Straw yield also increased with each increment of fertility level upto highest level. Application of 50%, 75% and 100% cow urine recorded 2.36%, 6.33% and 9.44% higher straw yield, respectively than control. It is apparent from the data that the fertility levels able to influence the harvest index to the level of significance in the year (2015 - 2016). Similarly, linear trend was noticed in harvest index with different concentrations of cow urine application as foliar spray.

On the basis of the result obtained from the experiment, it can be concluded that 100% RDF and four sprayings of cow urine should be rice to be proved most effective in increasing growth and yield of wheat under the integrated farming system.

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