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Yield, nutrient contents and their uptake by wheat (*Triticum aestivum)* crop in relation to FYM and potassium fertilization

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Abstract

A field experiment was conducted at R.B.S College, Agricultural Research Farm, Bichpuri, Agra for Rabi seasons of 2018-19 to study on yield, nutrient contents and their uptake by wheat (Triticum aestivum) crop in relation to FYM and potassium fertilization. The soil application of FYM @ 10 t ha^{-1} and 80 kg ha^{-1} potassium as is recommended to the farmers for getting better production of wheat crop. Application of FYM improved the content and uptake of nitrogen, phosphorus, potassium and zinc by the wheat crop. Similarly, the content and uptake of these nutrients increased with higher level of potassium application.

Key words: FYM, Potassium, Wheat Yield, Nutrients uptake,

Introduction

Wheat (*Triticum aestivum*) is an exhaustive feeder and requires substantial amount of nutrients for higher productivity. Potassium and FYM are the principal plant nutrients normally used for wheat fertilization. Potassium helps in translocation of metabolites from vegetative parts to reproductive ones, increases plant resistance to drought and frost. The research done since then has elucidate the role of potassium in plant metabolism and shows than has shows that this element activates more than 60 enzymes or enzymatically catalyzed systems involved in photosynthesis, metabolism and translocation of carbohydrate and protein, membrane permeability, stomatal regulation and water utilization. Other benefits ascribed to potassium include utilization of nitrogen, improved utilization of sunlight during cool and cloudy periods, enhanced resistance of plants to pests, diseases. FYM is a good source of nutrients and contributed towards build up of organic matter in soil (Das et al.2008). The application of FYM in the soil helps in increasing the fertility of the soils as well as physical condition including its water holding capacity. The recent researches indicate that a judicious combination of organic manures and fertilizers can better maintain the long- term soil fertility and sustain high levels of productivity. Hence, present investigation was carried out to study the yield, nutrient contents and uptake behavior of wheat to define optimum dose under integrated use of FYM and potassium.

Materials and methods

A field experiment was conducted during rabi seasons of 2018-19 at R.B.S college, Agricultural Research Farm, Bichpuri, Agra. The important soil properties of the field were: pH (1: 2.5 soil water suspension) 8.4, organic carbon (%) 0.40, Available nitrogen145.50 kg/ha, available Phosphorus 17.00 kg ha^{-1}, available Potash 185.5 kg ha^{-1}, available zinc 2.40 ppm. The texture of soil is sandy loam. Treatment consisted four levels of each FYM (0,2.5,5.0,10.0 t ha^{-1}) and Potassium (0,40,80,120 kg K_2O ha^{-1}). These treatment combinations were replicated thrice in a Randomized Block Design. The levels of FYM and Potassium were applied as per treatment. The wheat variety HD-2967 was sown on 29 November using 100 kg seed ha^{-1}. Appropriate management practices were adopted to raise the crop. Grain and straw yields were recorded at harvest of the crop. Samples were analyzed for N Snell and Snell (1955), Jonson and Ulrich (1959) and K (flame photometer) by adopting standard procedures. The available N Subbiah and Asija (1956), P Olsen et al., (1954), K (flame photometer) and Zn (AAS) status of soil after harvest of the crop was estimated by standard methods.

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Results and discussion

Grain and straw yield of wheat increased significantly with increasing levels of FYM. It is quite clear that maximum grain and straw yield of wheat was recorded under highest level of FYM (10 t ha^{-1}) (Table 1). From these results it may be inferred that the beneficial effect of FYM is due to its contribution in supplying additional plant nutrients, improvement of soil physical conditions and biological process in soil. Metabolites root activities increased resulting absorption of moisture and other nutrient enhanced resulting in to higher production. Similar results were observed by Kumar et.al, (2010) and Chauhan et al, (2010). Increase in straw yield of wheat with F_1, F_2 and F_3 were 14.08,19.06 and 20.44 % over control respectively. It may be due to the gradual release and steady supply of nutrients from human organics throughout the growth and development of wheat crop. Similar observations were also reported by Jat et al, (2008) and Sisodia et al, (2010). It is evident from Table 1 that grain and straw yield of wheat significantly affected by potassium levels. It is also noted that K_2 level of Potassium (80 kg ha^{-1}) proved better over control in case of enhancement in grain yield of wheat. The increase in grain yield of wheat with K_1(40 kg ha^{-1}), K_2 (80 kg ha^{-1}) and K_3(120 kg ha^{-1}) were 13.2, 25.03 and 19.14 percent over control, respectively. These results are in favour of Kumawat and Kumawat (2009), Singh et al, (2010) and Dixit et al., (2011). Time increase in straw yield with K_1, K_2 and K_3 were 14.16, 25.83 and 22.22 percent over control respectively, similar results were observed by Kumawat and Kumawat (2009) and Singh et al., (2010). It could be inferred from Table 2 that nitrogen content in grain and straw of wheat significantly affected by the doses of FYM. The F_3 level of FYM proved better in case of nitrogen content of wheat. It is also clear that nitrogen content of wheat increased with increasing doses of FYM. It might be due greater availability of nutrients under adequate supply of available nutrients by FYM application. The beneficial influence of applied FYM has been reported by Sisodia et al., (2010) and

Table 1: Effect of FYM and potassium on grain and straw yield (t ha^{-1}) of wheat crop

Treatment	Grain Yield (t ha^{-1})	Straw Yield (t ha^{-1})
FYM Levels:		
F_0	2.60	3.62
F_1	2.80	4.13
F_2	2.99	4.31
F_3	3.10	4.36
S.Em+-	0.020	0.40
C.D at 5%	0.056	1.13
Potassium Levels:		
K_0	2.56	3.60
K_1	2.90	4.11
K_2	3.21	4.55
K_3	3.05	4.40
S.Em+-	0.020	0.40
C.D at 5%	0.056	1.13

Table 2: Effect of FYM and Potassium on N, P and K content (%) of wheat crop

Treatment	Nitrogen Content (%)		Phosphorus Content (%)		Potassium Content (%)	
	Grain	Straw	Grrain	Straw	Grain	Straw
FYM Levels:						
F_0	2.41	0.40	0.57	0.042	0.45	1.59
F_1	2.56	0.43	0.59	0.047	0.49	1.92
F_2	2.69	0.46	0.62	0.053	0.53	2.19
F_3	2.85	0.48	0.66	0.056	0.60	2.48
S.Em+-	0.004	0.471	0.004	0.001	0.01	0.055
C.D at 5%	0.124	0.007	0.113	0.003	0.003	0.155
Potassium Levels:						
K_0	2.40	0.404	0.56	0.043	0.44	1.57
K_1	2.55	0.434	0.58	0.044	0.47	1.92
K_2	2.85	0.467	0.65	0.055	0.55	2.54
K_3	2.67	0.460	0.63	0.051	0.55	2.50
S.Em+-	0.044	0.0023	0.004	0.001	0.01	0.055
C.D at 5%	0.124	0.007	0.113	0.003	0.003	0.155

Table 3: Effect of FYM and potassium on N, P and K uptake (kg ha^{-1}) by wheat crop

Treatment	Nitrogen uptake (kg ha^{-1})			Phosphorus uptake (kg ha^{-1})			Potassium uptake (kg ha^{-1})		
	Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total
FYM Levels:									
F_0	62.67	14.51	77.18	13.21	1.51	14.72	11.66	57.24	68.90
F_1	72.50	17.84	90.34	16.58	1.93	18.51	13.77	78.91	92.68
F_2	81.30	19.73	101.03	18.60	2.40	21.00	15.90	93.96	109.86
F_3	88.70	20.44	109.14	20.39	2.43	22.82	18.54	107.63	126.17
S.Em+-	1.88	0.51	2.42	0.47	0.118	0.60	0.35	4.22	2.62
C.D at 5%	5.31	1.44	6.84	1.33	0.508	1.69	0.99	11.92	7.39
Potassium Levels:									
K_0	61.45	14.39	75.84	14.28	1.54	15.82	11.22	56.05	67.27
K_1	73.99	17.66	91.65	16.76	1.80	18.56	15.24	78.33	93.57
K_2	91.54	21.07	112.61	20.73	2.49	23.22	17.54	114.80	132.34
K_3	81.51	20.06	101.57	19.03	2.23	21.26	16.06	96.58	122.64
S.Em+-	1.88	0.51	2.42	0.47	0.118	0.60	0.35	4.22	2.62
C.D at 5%	5.31	1.44	6.84	1.33	0.508	1.69	0.99	11.92	7.39

Singh et al., (2011). A critical observation of data given in Table 2 indicated that the potassium levels significantly affect the nitrogen content of in grain and straw of wheat. However, the nitrogen content of wheat increased with increasing levels of potassium as compared to each preceding lower level of potassium. The maximum nitrogen content of wheat was noted with highest level of potassium (80 kg ha^{-1}). Similar results were reported by Lal et al., (2012), Singh et al., (2005) and Tripathi et al, (2006). The phosphorus content in grain and straw of wheat increased significantly with application of FYM and potassium over control, similar to these findings Sisodia et al, (2010) and Singh et al., (2011) Arya and Kalra (1988) and Singh et al., (2005) respectively. Table 2 shows that the potassium content of wheat increased significantly with increasing levels of FYM. The similar results also noted by Sisodia et al, (2010) and Singh et al, (2011). Table 2 indicated that each higher level of potassium significantly resulted higher potassium content of wheat in comparison to preceding lower levels of potassium. The maximum potassium content was noted at P_2 levels of potassium K_2 @ 80 (kg ha^{-1}). The maximum significantly enhancement in nitrogen uptake by wheat crop was recorded at highest level of FYM F3 @ 10 t ha^{-1} as compared to control. The enhanced nitrogen content and straw yield due to the use of FYM may be the possible season for increasing nitrogen uptake by wheat crop. Similar results were observed by DAS and Ram (2005), Kumar et al, (2010) and Singh et al,.(2011). K_2 (80 kg ha^{-1}) level of potassium gave better performance regarding nitrogen uptake by wheat crop. The difference between K_2 and K_3 was not found significantly in case of nitrogen utilization by wheat crop. Similar to these findings Kumar et al, (2009), Kumawat and Kumawat (2009), Pathan et al, (2010) and Singh et al., (2010). The utilization of phosphorus enhanced significantly by the increasing level of FYM over control and preceding lower level of FYM. The enhanced phosphorus content and straw yield by using FYM may be the possible reason or increasing phosphorus uptake by wheat crop. Similar to these findings Lal et al, (2016), Sisodia et al, (2010), Kumar et al,. (2011) and Singh et al, (2011). The maximum utilization of phosphorus by wheat crop was recorded at K_3 @ 80 kg ha^{-1} level of phosphorus. Similar observations were also recorded by Kumar et al, (2009), Pathan et al, (2010) and Singh et al, (2010). Table 3 revels that the potassium uptake by wheat crop increased significantly with increasing levels of potassium as compared to control. Comparatively more significant potassium uptake was found with highest level F3 of FYM. Each higher level of phosphorus resulted more significant utilization of potassium in comparison to control. Kumar et al, (2009) and Pathan et al, (2010).

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