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Effect of different sources and application rate of potassium on growth and yield of wheat (*Triticum aestivum* L.) crop

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Abstract
A field experiment was conducted at farmer field of Buxar districts under supervision of Veer Kunwar Singh College of Agriculture Dumraon (Buxar) Bihar, during the year 2020-21 & 2021-22 in Rabi season on "effect of different sources and application rate of potassium on growth of and yield of wheat crop". Leaf Area Index at 80 DAS significantly higher in 75% RD of K +1/3rd paddy crop residues incorporation (T_5) followed by 75% RD of K + 25% K through FYM (T_6). Number of tillers at maturity significantly higher T_5-75% RD of K + 1/3rd paddy residue incorporation followed by T_3-125% RD of K as basal. Significantly higher grain yield was found in 75% RD of K +1/3rd paddy crop residues incorporation (T_5) followed by 125% RD of K as basal (T_3). Highest K-use efficiency found in 75% RD of K + 1/3rd paddy residue incorporation followed by 75% RD of K + 25% K through FYM (T_6) and T_7-75% RDK as basal + 25% RDK at 45 DAS. Highest potassium and nitrogen uptake in wheat grain were found highest in T_4-150% RD of K as basal followed by T_5-75% RD of K + 1/3rd paddy residue incorporation.

Keywords: Rabi season, crop residue, basal dose, leaf area index

Introduction
Wheat is a major *Rabi* crop of Bihar and potassium fertilizer applications have played major role in increasing wheat yield. It is grown in 2.1 million hectare area in Bihar having production of 4.7 million tonnes with productivity of 2.2 tonnes per hectare (Directorate of Statistical & Evaluation 2015-16). The productivity of wheat crop of the state is lower than productivity of our country i.e. about 3.0 tonnes per hectare. Farmers of the state are generally cultivated late maturing varieties of rice having 140 to 150 days and delayed harvesting of rice results delayed sowing of wheat crop. Late sown wheat is usually exposed to high temperature during flowering to grain filling stage and tends to less number of grains per spike and test weight ultimately reduction in yield.

Intensification of cropping system with greater use of potassium free chemical fertilizers and adoption of high yielding varieties have resulted in the mining of soils leading to K deficiency. Potassium is one of major nutrients considered essential for growth, yield development as well as protein content of plant as well as it play crucial role in stress condition. Its application increased root growth and improve drought resistance. Potassium uptake is more or less continuous throughout the different stages of growth.

The soils of Buxar district are low to medium in potassium content. It absorbed by plants in large amount than any other element except nitrogen and plays a key role in increasing crop yield and improving quality of products. K requirement of wheat is about 27 kg per ton grain yield. The most research data shows that basal and split application of potassium is equally good, but some recent studies conducted on crops show beneficial effect of split doses of potassium over basal doses, due to the fixation and leading loses in intensively cropped area. Keeping this view in mind, the proposal is being submitted with following objectives and it will be executed in farmers' participatory mode for the quick adoption of farmers in this region.

Materials and Methods

A field experiment was conducted at farmer field of Buxar districts during the year 2020-22 in Rabi season. The experimental plot situated at 25.5213 latitude, 84.1594 longitudes. The research location comes under Zone III- B of Bihar. The experiment consisted of nine treatments with the three replication under RBD. The treatment details are as follows, T_1-Control (No application of K), T_2-RD of K as Basal, T_3-125% RD of K as basal, T_4-150% RD of K as basal, T_5-75% RD of K + 1/3rd paddy residue incorporation, T_6-75% RD of K + 25% K through FYM, T_7-75% RDK as basal + 25% RDK at 45 DAS, T_8-75% RDK as basal + 25% RDK at 65 DAS, T_9-50% RDK as basal + 25% RDK at 45 DAS +25% RDK at 65 DAS. In the experiment Wheat variety was HD-2967. Texture of soil is clay loam, pH range is 7.10, Electrical Conductivity (EC) 0.34 (dS/m), low in organic C 0.46 Available phosphorus 17.8 (Kg/ha) Available Potassium 142.5 (Kg/ha).

Results and Discussion

Data presented in table No.1 the plant height was found higher under 75% RD of K + 25% K through FYM followed by 75% RD of K + 1/3rd paddy residue incorporation and 125% RD of K as basal similar results were found by Meena *et al.* (2018) [2]. Leave area index was found significantly higher in 75% RD of K + 1/3rd paddy residue incorporation, this investigation supported by Kajal *et al.* (2023) [4]. The data are presented in table No. 1 number of tillers per square meter at maturity (381.7) was significantly higher in 75% RD of K + 1/3rd paddy residue incorporation and significantly at par with treatment 125% RD of K as basal (361.6) was recorded with the rest of treatments similar trend found by Kajal *et al.* (2022) [3]. The data on dry matter accumulation through shoots are presented in table No. 1 recorded maximum (219.3 gm) in 75% RD of K + 1/3rd paddy residue incorporation and days to maturity recorded in 150% RD of K as basal, Madar *et al.* (2020) [8] also supported similar type of results.

Table 1: Effect of different sources and application rate of potassium on growth parameters of wheat

Treatments	Height at Maturity (cm)	LAI at 80 DAS	No. of tillers per sq meters at maturity	DM per Meter row length (gm)	Days to Maturity
T_1-Control (No application of K)	89.06	3.20	281.6	157.0	127
T_2-RD of K as Basal	98.30	3.63	345.3	184.7	129
T_3-125% RD of K as basal	100.20	3.73	361.6	188.0	133
T_4-150% RD of K as basal	98.57	3.88	354.3	199.0	135
T_5-75% RD of K + 1/3rd paddy residue incorporation	100.50	4.28	381.7	219.3	134
T_6-75% RD of K + 25% K through FYM	101.3	4.02	356	191.7	132
T_7-75% RDK as basal + 25% RDK at 45 DAS	94.13	3.60	351.3	185.3	130
T_8-75% RDK as basal + 25% RDK at 65 DAS	92.20	3.70	335	180.0	128
T_9-50% RDK as basal + 25% RDK at 45 DAS +25% RDK at 65 DAS	90.50	3.63	324	173.0	128
SEm±	3.8	0.13	13.07	10.33	1.9
CD at 5%	NS	0.41	39.53	31.24	NS

The data (Table 2) shows that yield attributes like the, spike length (cm), and Test wt. (gm) increased significantly with each increasing dose of potassium and FYM over control. Grain yield of wheat increased significantly with increasing levels of FYM as reported by Kumar *et al.* (2010) [5], Sharma, Rad Das N. (2002) [14], Chauhan *et al.* (2011) [1] and Singh *et al.* (2019) [7].

Table 2: Effect of different sources and application rate of potassium on yield attributes and yield of wheat

Treatments	Test wt.(gm)	Spike length(cm)	Grain Yield (qt/ha)	Straw yield (qt/ha)
T_1-Control (No application of K)	35.2	9.60	33.64	49.87
T_2-RD of K as Basal	38.23	11.20	39.88	53.20
T_3-125% RD of K as basal	41.60	12.06	43.33	56.73
T_4-150% RD of K as basal	41.36	11.80	41.40	58.86
T_5-75% RD of K + 1/3rd paddy residue incorporation	44.03	12.40	45.71	59.67
T_6-75% RD of K + 25% K through FYM	40.90	11.93	44.67	60.33
T_7-75% RDK as basal + 25% RDK at 45 DAS	40.10	10.53	40.42	55.00
T_8-75% RDK as basal + 25% RDK at 65 DAS	39.60	10.43	40.1	51.67
T_9-50% RDK as basal + 25% RDK at 45 DAS +25% RDK at 65 DAS	39.06	10.17	39.10	50.66
SEm±	1.38	0.54	2.1	2.26
CD at 5%	4.17	1.62	6.3	6.82

Data presented in table no. 2 in reference to grain yield 75% RD of K + 1/3rd paddy residue incorporation which was significantly more as compare to other treatments but statistically at par with 75% RD of K + 25% K through FYM as also reported by Akhter *et al.* (2017) [11], Vijaya Kumar *et al*. (2019) [10] and Sharma *et al.* (2023) [12].

Conclusion

Significantly higher grain yield was found in 75% Recommended dose of Potassium along with 1/3 rd paddy crop residues (T_5) statistically at par with 75% Recommended dose of Potassium and remaining 25% from FYM (T_6) followed by in 125% RD of K (T_3) and 150% RD of K as basal (T_4). Effect of different sources and application rate of potassium on growth parameters of wheat were found significantly higher among leaf area index at 80 days after sowing, number of tillers per square meter at maturity and dry matter per meter row length but height and days to maturity were found non-significant.

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