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Influence of K_2O - Fertilizer Application on Growth, Yield and Lodging of Paddy Rice

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ABSTRACT

This study was conducted to investigate the influence of K_2O fertilizer application on growth, yield and lodging resistance of rice. Culm length and panicle length were lowest at the treatment of fertilizer level, N-P_2O_5-K_2O=16-8-8 plot but number of panicle, percentage of fruitful culm, 1ℓ grain weights of paddy rice and brown rice, 1,000 grains weight of brown rice, brown rice ratio, yields of paddy rice and brown rice were highest at the treatment of fertilizer level, N-P_2O_5-K_2O=16-8-8 kg/10a plot.

Bending moment, breaking strength and lodging index were lowest at the treatment of fertilizer level, N-P_2O_5-K_2O=16-8-8 kg/10a plot. Judging from the results reported above, an optimum fertilizer level of rice for lodging resistance is most likely be N-P_2O_5-K_2O=16-8-8 kg/10a treatment.

Key Words **:** K_2O, lodging, paddy rice

INTRODUCTION

An adequate supply of potassium in the soil improves the quality of the plant, insures-greater efficiency in photosynthesis, increases resistance to certain diseases, helps to balance an oversupply of nitrogen, and aids plants to utilize soil moisture more advantageously. It also insures the development of well-filled kernels and stiff straw in the cereals, encoruages growth in leguminous crops, assists in chlorophyll formation, and is particularly helpful in the production of starch or sugar forming crops (Cooper *et al.*, 1938; Dean, 1957). Potassium is particularly beneficial to tobacco, potatoes, cotton, sugarbeets, and certain cereals.

Potatoes grown with too little potassium may be watery, low in starch, and generally poot in quality. Insufficient potassium levels of the tobacco plant may have poor color and flavor, and lack burning qualities. Crops usually respond to potash fertilizers in the Atlantic coastal plain, in regions of high rainfall in the eastern third of th United States (except in certain portions of the piedmont), and on sandy, muck, and peat soils of the Great Lakes region. Potash is usually abundant in soils of volcanic origin. The ordinary range of potassium expressed as potash (K_2O) in the plow surface of mineral soils is 0.15 percent in sands to 4.0 percent or more in clay soils (Dean, 1957). This experiment was conducted to examine the effects of K_2O fertilizer application on growth, yield and lodging

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of paddy rice.

MATERIALS AND METHODS

Norin 8 rice variety was grown at the experimental field of Gwangju city in Korea. Seeds were grown in nursery bed on May 4 and seedlings were transplanted in the paddy field with 30×15 cm distance with one plant per hill on June 10, experiment was conducted with 4 compositions of fertilizer levels at the experimental field of rice in Gwangju national experimental field.

The complete randomized block design was used and treatment was randomized in each of the three blocks. The size of each experimental unit was $25m^2$ (5 m×5 m). Soil properties of the experimental plot at the beginning of experiment was the same as this given in the Table 1. The levels of fertilizer application was the same as this given in the Table 2.

Twenty plants were randomly sampled from each plot at harvesting stage, culm length, panicle length, number of panicles and number of fruitful culm and the lodging inedx (%), bending moment (g/cm) and braking strength (g) were measured by the guide investigation from Nat'l Institute of Crop Science, RDA. To determine yield, rice plants in 1 m2 from each plot were harvested by cutting at about 5 cm above soil level. After threshing rice, the brown rice grains were measured.

RESULTS AND DISCUSSION

Yield components and yield

Mean values of agronomic characteristics, yield components and yield are presented in Table 3 and 4. All the dates of heading and maturing in the different

Table1. Soil properties of the experimental plot at the beginning of experiment

PH(1:5)	OM(%)	P_2O_5(ppm)	SiO_2(ppm)	K(mg)	Ca(mg)	Mg(mg)	CEC(mg)
5.7	2.4	110	95	0.27	4.0	1.6	9.6

Table 2. The levels of fertilizer application (kg/10a).

Fertilizer \ Level	1	2	3	4
N	16	16	16	16
P_2O_5	8	8	8	8
K_2O	0	4	8	12

Table 3. Variation of agronomic characteristics of paddy rice

Fertilizer \ Level	Heading date	Maturing date	Culm length (cm)	Panicle length (cm)	No. of panicle	Percentage of fruitful culm(%)
N-P_2O_5-K_2O						
16 - 8 - 0	Aug. 24	Oct. 14	93.6	20.3	11.6	44.6
16 - 8 - 4	Aug. 24	Oct. 14	97.0	22.9	11.9	46.1
16 - 8 - 8	Aug. 24	Oct. 14	98.1	23.2	12.4	48.4
16 - 8 - 12	Aug. 24	Oct. 14	92.0	20.1	11.3	48.1
L.S.D(0.05)	-	-	5.24	3.01	1.05	4.02

Table 4. Variation of yield and yield components of paddy rice

Fertillzer levels N-P_2O_5-K_2O	1 ℓ grain wt.(g)		Wt. of 1,000 grains of brown rice(g)	Ratio of brown rice	Yield (kg/10a)		Index
	Paddy rice	Brown rice			Paddy rice	Brown rice	
16 - 8 - 0	587	823	24.7	81.5	370.3	302.0	136
16 - 8 - 4	590	824	24.8	82.3	406.4	334.5	151
16 - 8 - 8	597	827	24.8	87.4	418.2	365.7	165
16 - 8 - 12	583	820	24.3	81.4	352.9	288.0	131
L.S.D(0.05)	13.80	6.49	0.53	6.43	68.63	78.16	34.63

Table 5. Variation of lodging, disease and injurious insects of paddy rice

Fertilizer levels (N-P_2O_5-K_2O)	Wt. of per plant (g)	Bending moment (g/cm)	Breaking strength (g)	Loging index (%)	Sheath blight (0-9)	Blast of panicle (0-9)
16 - 8 - 0	43.9	969.9	498.4	244.3	2.7	1.7
16 - 8 - 4	44.9	992.7	449.3	2004.4	1.7	1.0
16 - 8 - 8	48.7	967.1	440.6	201.2	1.1	1.0
16 - 8 - 12	42.9	1,013.0	467.4	217.6	1.3	1.0
L.S.D(0.05)	5.70	48.42	57.48	44.22	1.6	0.75

treatments were same dates with Aug 24 and Oct. 14 respectively.

Culm length, panicle length, number of panicle and percentage of fruiful culm increased as fertilizer level by the N-P_2O_5-K_2O = 16-8-8 kg/10a. Grain weight of one lither, weight of one thousand granins of brown rice, ratio of brown rice and rice yield increased as fertilizer level by N-P_2O_5-K_2O = 16-8-8 kg/10a also. Yield was the highest in fertilizer level, N-P_2O_5-K_2O = 16-8-8 kg/10a with 418.2 kg/10a in paddy rice, 365.7 kg/10a in brown rice. The fertilizer level, N-P_2O_5-K_2O = 16-8-8 kg/10a in paddy rice, 288.0 kg/10a in brown rice and in other fertilizer levels ranged from 370.3 kg/10a, 302.0 kg/10a to was 352.9 kg/10a 406.4 kg/10a, 334.5 kg/10a respectively.

There were significant differences in all characters among fertilizer level at the 5% level. According to Kwon(1968), Kim *et al*, (1992), Park *et al*, (1973), and Lim *et al*, (1991), fertilizer level affected yield and yield components. Based on the results obtained so far, plants grow more upwards as fertilizer level is higher by the N-P_2O_5-K_2O = 16-8-8 kg/10a in rice culture at southern area of Korea.

Lodging resistance, disease and pest injury

The menas of lodging index weight of per plant, bending moment, bending moment, breaking strength, sheath blight and blast of panicle are presented in Table 5. Lodging index ranged from 201.2 to 244.3 percent. The results were in agreement with the reports (Kwon, 1968). There were satistically significant differences in lodging index among fertilizer levels and the fertilizer level, N-P_2O_5-K_2O = 16-8-8 kg/10a was the lowest in lodging index with 201.2 percent.

Mean values of bending moment, breaking strength, sheath blight and blast of panicle for fertilizer level, N-P_2O_5-K_2O = 16-8-8 kg/10a were 967.1~1013.0, 440.6~498.4, 1.1~2.7 and 1.0~1.7 degree respectively (Table 5).

There were significant differences among fertilizer levels. The fertilizer level of N-P_2O_5-K_2O = 16-8-8 kg/10a was the lowest lodging, disease and pest injury. The results were fairly in agreement with those of kwon (1968) reported that the lowest lodging, disease and pest injury.

Fertilizer level, N-P_2O_5-K_2O = 16-8-8 kg/10a is considered to be a suitable fertilizer level of rice culture at the southern area of Korea.

LITERATURE CITED

Cooper, H. P., Schreiner, O., and Brown, B. E. 1938. "Soil potassium in relation to soil fertility." in Soils and Men, USDA Yearbook, pp. 397-405.

Dean, L. A. 1957. " Plant nutrition and soil fertility." in Soil, USDA Yearbook, pp. 80-94.

Kim H. J., J. T. Lim and B. S. Kwon. 1992. Lodging and yield of direct surface seeded rice as influenced by N levels, PP 333 treatments, and seeding rates. Korean J. Crop Sci. 37(1) : 9-15.

Kwon B. S. 1968. Effects of 2.4 D and K_2O on Lodging of rice. Experiment Research Report of Chonnam Provincial Rural Development Administration. 147-153.

Lim J. T., B. S. Kwon and B. G. Jung. 1991. Relationship between lodging related characteristics and field lodging in rice. Korean J. Crop Sci. 36(4) : 319-323.

Park R. K., J. K. Park and K. H. Lee. 1973. Effect of lodging resistance for the rice varieties and cultural practices in transplanted rice. RDA. J. Agri. Sci(crop) 15 : 45-54.

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