RESPONSE OF ONION TO NPKS FERTILIZERS IN LOW GANGES RIVER FLOOD PLAIN SOIL

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ABSTRACT

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An investigation was conducted at farmers' field of Baliakandi, Rajbari, during three consecutive rabi seasons of 2001 to 2003 to find out the optimum fertilizer dose of onion for greater Faridpur region under AEZ 12. Four different levels of NPKS viz. control, medium yield goal (MYG), high yield goal (HYG) and HYG X 1.3 were tested with Taherpuri variety of onion. Average of three years study reveals that a considerable response of onion to NPKS was observed. However, the response to N and P was more distinct in comparison to K and S. From the average yield data, a response curve was drawn and the relationship was quadratic in nature. The nutrient dose that maximized yield (107-72-90-33 kg NPKS/ha) as well as profit (95-50-70-32 kg NPKS/ha) of onion cultivation was found out from the response curve.

Key words: Onion, response, NPKS and low Ganges flood plain soil

INTRODUCTION

Onion (*Allium cepa* L.) is the main spices crop in Bangladesh. It is widely used in cooking as spices, salad, and food dressing and also for medicinal purposes. The annual production of onion in Bangladesh is about 150000 metric tons in about 91000 acres of land during the 2001-2002 growing season (BBS 2001). The authorized import is about 47,000 tons in 1998 costing about 10.3 million US dollar (FAO, 1999). In Faridpur, onion is a major cash crop. It covers about 15,955 acres in greater Faridpur, the largest coverage of Bangladesh and the production of onion is about 25750 metric tons (BBS 2001). Onion being a cash crop, increment of yield with balanced fertilization is one of the most important factors. Usually, farmers use fertilizers based on their own idea that make the soil heterogeneous causing declination of soil fertility in a long run. Farmers also suffers economic loss on the yield and they obtain only 12.50 t/ha on an average. But there is enough scope to increase yield with balanced fertilization. The requirement of fertilizers by the crop is also dependent on the residual effect of the applied fertilizer in the previous crop. It was reported that P, K, S and Zn exerted residual effect to the succeeding crop (Fertilizer Recommendation Guide 1997). The existing soil status of the area is very important to recommend a balanced fertilizer dosage for a specific crop. The land was medium low having clay loam soil with pH value of 5.8 to 6.9 under the low Ganges river floodplain soils of agroecological zone 12. Farmers of the area grow two to three crops in a same piece of land in a year. They cannot assess how much fertilizer remains in the field for the next crop and how much would be applied to achieve higher yield in respect of benefits. As any location specific fertilizer recommendation is not available, this study was designed to find out optimum and economic dosage of onion for greater Faridpur in Bangladesh.

MATERIALS AND METHODS

The experiment was conducted on farmer's field of multilocation testing site (MLT), Baliakandi under Rajbari district during Rabi seasons of 2001, 2002 and 2003. The experimental plot of onion was laid out in randomized complete block design with six dispersed replications. The variety was Taherpuri. Seed rate was 3-4 kg/ha. The unit plot size was 8m x 6m. The initial soil status was organic matter range from 1.86 to 3.27 %. The total N was 0.16%. P, K and S level were 1.84, 0.44 and 18.84 microgram/gm soils, respectively (Appendix table 1). Four different levels of N, P, K and S were tested.

Nutrient Levels	Kg/ha			
	N	P	K	S
Control	0	0	0	0
MYG	75	60	50	15
HYG	100	80	100	30
HYG X 1.3	125	100	150	45

Fertilizer doses were calculated according to original soil status of the experimental plots using Fertilizer Recommendation Guide (FRG) 1997. The entire quantity of P, K, S with one half of N were applied as basal dose at the time of final land preparation and the remaining half N was applied as top dress. The source of NPK and S were Urea, TSP, MP and Gypsum, respectively. The 45 days old onion seedlings were transplanted in the 1st week of January with a spacing of 20cm x 8cm. The remaining half of N was applied as top dress during first (25 DAT) and second mulch (55 DAT) in two equal splits. Two irrigations were applied before the first and second top dressing of N application. The crop was harvested in 1st week of April. Data on plant parameters, bulb yield and local market price of fertilizers and fresh onion were collected properly. The optimum and economic dose of fertilizer nutrients were calculated using the formula Y= -b/2c and Y= 1/2c (Pf/Py-b) respectively, where Pf= price of fertilizers and Py= price of onion yield, from the response curve according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

No significant difference of plant height as affected by different levels of nutrient elements was observed (Table 1). Diameter of bulb under different levels of single nutrient elements was identical except the control. Aujla and Madan (1992) reported that N application and closer row spacing influence the girth of bulb of onion. Bulb weight is an important yield contributing character for onion. Average weight of single bulb increased significantly over control in response to different levels of nutrient elements and that was reflected in the yield. The yield of onion in different years as affected by different levels of fertilizers is presented in Table 2. The data indicated that fertilizer application significantly increased the bulb yield of onion in all nutrient elements (NPKS) over the control. It was observed that 100 kg N/ha, 80 kg P/ha, 50 kg K/ha and 30 kg S/ha individually performed the highest yield of onion in three consecutive years.

Table 1. Yield parameters of onion as affected by different levels of nutrients

Fertilizer level (kg/ha)	Plant height (cm)	Bulb diameter (cm)	Single Bulb wt. (g)
N level			
0	35.17b	2.10b	13.67c
75	42.17a	2.48b	30.00b
100	43.43a	3.17a	38.12a
125	46.43a	2.58a	32.25ab
CV%	13.5	11.2	12.8
P level			
0	44.14a	2.28b	20.27c
60	47.83a	2.34a	33.69b
80	47.79a	2.78a	38.46a
100	47.93a	2.45a	29.62b
CV%	14.2	12.7	13.1
K level			
0	47.79a	2.45b	24.00b
50	48.47a	3.38a	41.09a
100	47.16a	3.17a	39.35a
150	47.83a	2.55a	34.88a
CV%	12.9	11.1	11.8
S level			
0	42.53a	2.52b	23.43b
15	47.16a	3.17a	26.59a
30	48.21a	3.38a	37.34a
45	48.49a	3.28a	32.32a
CV%	13.1	12.5	12.8

Table 2. Yield of onion as affected by different levels of nutrients

Fertilizer level (kg/ha)	Bulb yield (t/ha)			Mean (t/ha)
	2001	2002	2003	
N level				
0	7.52b	7.68b	7.05b	7.42
75	13.25a	13.50a	12.53a	13.09
100	14.85a	15.42a	14.85a	15.04
125	14.20a	14.22a	12.77a	13.73
CV%	11.5	12.7	10.9	
P level				
0	10.95b	9.70b	7.98bb	9.54
60	14.10a	14.55a	12.83a	13.83
80	14.85a	15.42a	14.85a	15.04
100	13.97a	14.17a	13.00a	13.71
CV%	12.1	11.5	9.8	
K level				
0	11.70b	11.55b	11.94b	11.73
50	15.00a	15.48a	14.96a	15.14
100	14.85a	15.42a	14.85a	15.04
150	14.78a	15.32a	14.72a	14.94
CV%	11.7	12.4	10.5	
S level				
0	11.00b	10.45b	9.28c	10.24
15	13.45a	13.48a	11.57b	12.83
30	14.85a	15.42a	14.85a	15.04
45	14.10a	14.20a	13.36a	13.89
CV%	12.3	11.8	10.7	

Effect of N

As the total N % of the experimental soil was low, the bulb yield of onion increased with the increasing level of nitrogen upto 100 kg/ha and further application of N decreased the yield (13.73 t/ha). Similar result was also observed by Ali and Haque (1994). They found the highest yield (16.00 t/ha) with 100 kg N/ha in Faridpur soil.

Effect of P

Yield of onion increased gradually up to the application of 80 kg/ha (15.04 t/ha) and thereafter decreased (13.71 t/ha). Initial P status of the soil was low. So, 80 kg P/ha was found responsive for higher yield. Gupta and Gaffar (1990) found the highest yield of onion bulb (16.6 t/ha) by the application of 54-kg P/ha.

Effect of K

In case of K the highest bulb yield (15.14 t/ha) was found with 50 kg/ha. This phenomena could be explained that the soils of Low Ganges River Floodplain are rich in K (Appendix table-1) and that's why lower dose of K showing the maximum response. After that level the bulb yield did not increase appreciably. The over all response of onion to potassium was not very clear. Ahmed *et al.* (1987) observed the performance of Taherpuri onion variety at Rajbari was 8.42 t/ha with 65 kg K/ha.

Effect of S

Increasing rate of S application increased the yield of onion and the maximum response was found with 30 kg S/ha (15.04 t/ha). Medium soil S status was observed in the experimental area. So, moderate dose of S was found responsive. Ahmed *et al.* (1988) reported that the diameter and weight of bulbs were significantly improved with the application of S up to 24 kg/ha. Balasubramonium *et al.* (1979) studied that the added S had

positive effect in increasing the yield of onion but a reduction in yield with very high dose of S was also observed.

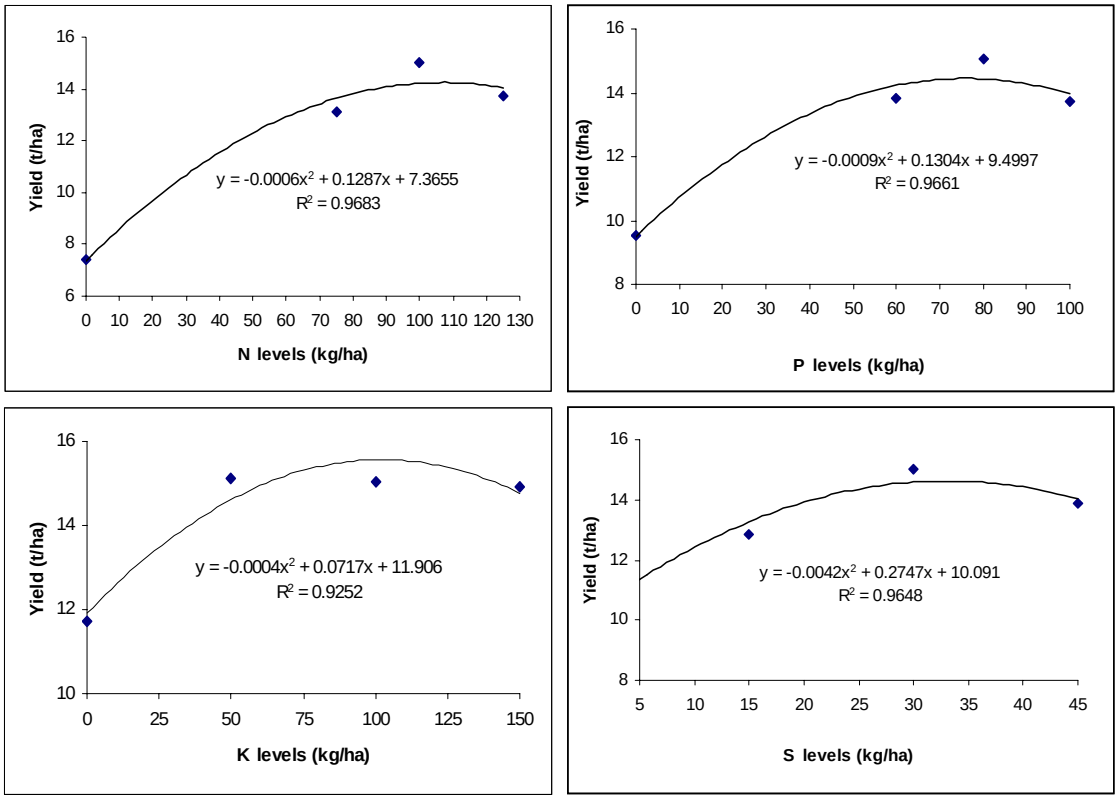

Fig.1. Response of onion to N, P, K, and S at Baliakandi, Rajbari, in greater Faridpur region

]Regression analysis

Regression analysis of onion yield on an average of 3 years was done to fit the quadratic functions for estimating the optimum levels of each nutrient over the different levels of NPKS/ha (Fig.1). The large and significant R^2 value of NKPS of regression indicates that the quadratic response fitted the data. Response curve shows that yield increased with the increasing of nutrients at certain level and thereafter yield was decreased. From the regression equations for onion (Table 3) the agronomically optimum levels of NPKS/ha were estimated as 107-72-90-33 kg NPKS/ha and the economically optimum fertilizer doses were estimated 95-50-70-32 kg NPKS/ha for maximum onion yield of 14.26, 14.21, 15.11 and 14.58 t/ha respectively.

Table 3. Response function of onion to N, P, K and S for onion yields

Nutrient	Regression equation	R2	Optimum rates of nutrient (kg/ha)	Maximum yield (t/ha) at optimum level of nutrient
N	Y=7.3655+0.1287x-0.0006x2	0.96	95	14.26
P	Y=9.4997+0.1304x-0.0009x2	0.96	50	14.21
K	Y=11.906+0.0717x-0.0004x2	0.92	70	15.11
S	Y=10.091+0.2747x-0.0042x2	0.96	32	14.58

From the above discussion, the cumulative result indicated that fertilizer dose that maximized yield was 107-72-90-33 kg NPKS/ha while 95-50-70-32 kg NPKS/ha was profitable for onion in respect of yield and economics. The present recommended dose is relatively lower but judicious that ensures higher yield than that of farmer's traditional practices and will be helpful to improve soil health for sustainable higher yield. So, 95-50-70-32 kg NPKS/ha for onion could be proposed for recommendation in greater Faridpur.

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APPENDIX

Table 1. Initial soil status of the experimental site at Baliakandi, Rajbari

Replication	PH	Total N %	P ppm	K meq/100g soil	S ppm
01	6.2	0.17	1.96	0.51	20.18
02	6.0	0.17	1.50	0.50	20.36
03	6.3	0.15	3.42	0.45	23.93
04	6.1	0.17	1.58	0.52	15.81
05	5.8	0.16	1.50	0.39	21.46
06	6.9	0.14	1.08	0.27	09.16
Mean	--	0.16 Low	1.84 V. low	0.44 V. high	18.48 Medium

Table 2. The price of inputs and the price of outputs at Baliakandi, Rajbari

Price of fertilizers	Farm gate price of fresh onion
Urea = 6.00 Tk/kg	Onion = 6.50 Tk./kg
TSP = 10.60 Tk/kg	
MP = 9.00 Tk/kg	
Gypsum = 2.50 Tk/kg	
Cowdung = 0.40 Tk/kg	