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Fertilizer requirements of drumstick cv. PKM-1

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ABSTRACT

The experiment was conducted in Factorial Randomized Block Design (FRBD) with three replications at Horticulture Research Farm under middle Gujarat agro-climatic zone –III (AES-II) during the year 2005, 2007 and 2008. Treatment involved three levels of nitrogen and two levels of potash. Pruning was done on first week of May and planting was done at distance of 2.5 x 2.5 meter distance. Treatment involved three levels of nitrogen and one level of potash. The nitrogen fertilizer @ 25 g/ plant gave significantly maximum plant height, number of branches, length of branches (cm), diameter of branches (cm), weight of pod (g), length of pod (cm), diameter of pod (cm), number of pods per tree, yield of pods per tree (kg), yield of pods (t/ha) and total soluble solids. From the experiment and conclusion, the farmers are advised to apply 100 g nitrogen, 25 g potash and 10 Kg FYM per plant. Among them the half dose of nitrogen, full dose of potash and FYM should be given in first week of May after pruning and remaining half dose of nitrogen in the month of October to drumstick cv. PKM-1 for obtaining higher yield (46.79 t/ ha.) with net return (Rs.1,21,926) and higher CBR (1 : 7.61).

Key words : Drumestick, Fertilizer management, Nitrogen, Potash

INTRODUCTION

The drumstick tree grows mainly in semi arid tropical and sub-tropical areas while, it grows best in dry sandy soil. It tolerates poor soil, including coastal areas. It is a fast growing drought resistant tree. The plant starts bearing 6 to 8 months after planting but regular bearing commences after the second year. The tree bears for several years. It does not tolerate freezers or frost. It can also be propagated by seed. Drumstick is a medium size (10 m high) deciduous, nitrogen fixing tree. The tree is good source for calcium and phosphorus. The immature green pods called 'drumsticks' are probably the most valued and widely used part of the tree. They are commonly consumed in India.

Fertilizer management plays an important role for growth and development of crop. Optimum application of different fertilizers increase growth, development and yield of crop. According to recent trend increasing the levels of increase the production due to increased nutrition level per unit area. (Vachhani and Patel, 1993). Fertilizer management is one of the important factors for bringing a significant increase in crop yield. Among the major plant nutrients, response of nitrogen and potash to drumstick crop is of great importance which is directly reflected on growth, yield and quality of drumstick crop. In the present context of higher prices of fertilizers, it is necessary to work out the optimum and economic requirement of fertilizer for drumstick crop.

MATERIALS AND METHODS

The experiment was conducted at Horticulture Research Farm, Department of Horticulture, B.A. College of Agriculture, Anand Agricultural University, Anand under middle Gujarat agro-climatic zone –III (AES-II) during 2005, 2007 and 2008. The experiment was laid out in Factorial Randomized Block Design (FRBD) with three replications. Plants were planted at distance of 2.5 x 2.5 meters. Pruning was done on first week of May. Treatment involved three levels of nitrogen *i.e.* N_0 = 0 g/ plant, N_{50} = 50 g/ plant and N_{100} = 100 g/ plant and different levels of potash *i.e.* K_0 = 0 g/ plant and K_{25} = 25 g/ plant. FYM @ 5 kg per plant applied at the time of planting and 10 kg FYM in every year after pruning in the month of May. Nitrogen was given in two splits. Half dose of nitrogen and full dose of potash given in the month of May and second dose of nitrogen in the month of October.

RESULTS AND DISCUSSION

The data on plant height and number of branches per plant showed that, when the nitrogen fertilizer applied at the rate of 100 g/plant gave significantly more plant height (5.50 m) as compared to control (3.99 m) (Table 1). The treatment of 50 g nitrogen/ plant was at par with 100 g nitrogen/ plant in all the three years. Potash (K) fertilizer @ 25 g/plant gave significantly more plant height (5.15 m) as compared to control (4.52 m). All the other interaction effects were found non-significant.

An application of nitrogenous fertilizers @ 100 g/ plant gave significantly higher number of branches in all the three years (5.93, 8.33, 8.33) and in pooled (7.03) as compared to control. Second effective treatment was nitrogen @ 50 g/plant. Potash (K) fertilizer @ 25 g/plant

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Table 1: Effect of chemical fertilizers on plant height (m) and number of branches of per plant in drumstick cv. PKM-1

Treatment	Plant height (m)				Number of branches per plant			
	Year			Pooled	Year			Pooled
	2005	2007	2008		2005	2007	2008	
N levels (g/plant)								
N_0	3.20	4.45	4.33	3.99	4.48	6.30	6.08	5.62
N_{50}	4.43	5.31	5.25	5.00	5.65	6.92	6.67	6.41
N_{100}	5.05	5.70	5.76	5.50	5.93	8.33	8.33	7.03
S. E. ±	0.289	0.211	0.210	0.138	0.223	0.339	0.347	0.178
C.D. (P=0.05)	0.910	0.664	0.661	0.399	0.702	1.068	1.093	0.514
K levels (g/plant)								
K_0	3.82	4.96	4.78	4.52	5.06	7.19	6.89	6.38
K_{25}	4.63	5.36	5.44	5.15	5.66	7.18	7.17	6.67
S. E. ±	0.236	0.172	0.171	0.113	0.182	0.277	0.283	0.149
C.D. (P=0.05)	2.743	NS	0.540	0.326	0.573	NS	NS	NS
Interaction								
Y x N	NS	NS	NS	NS	NS	NS	NS	NS
Y x K	NS	NS	NS	NS	NS	NS	NS	NS
N x K	NS	NS	NS	NS	NS	NS	NS	Sig
Y x N x K	NS	NS	NS	NS	NS	NS	NS	NS
C.V.%	16.73	10.01	10.05	12.13	10.19	11.56	12.09	11.57

NS = Non significant

Table 1.1 : Interaction effect of N x K (pooled) on number of branches per plant in drumstick cv. PKM-1

N x K	K_0	K_{25}
N_0	5.10	6.14
N_{50}	6.70	6.12
N_{100}	7.33	7.73
S. E. ±	0.252	
C.D. (P=0.05)	0.727	
C.V %	11.57	

gave higher number of branches but it was non-significant. The interaction effect of N x K found significant and gave higher number of branches (7.73) in $N_{100}K_{25}$ combination followed by $N_{100}K_0$ (7.33).

Length of branch was recorded and narrated in Table 2. It was found that the nitrogen fertilizer @ 100 g/plant gave significantly longer length of branch (4.01 m) followed by N @ 50 g/plant (3.47 m) as compared to control (3.14 m). The treatment K_{25} gave significantly higher length of branch in pooled (3.68 m) as compared to control (3.40 m). All the interactions were non-significant.

Nitrogenous fertilizers @ 50 g/tree significantly improved diameter of branch in pooled (5.64 cm) which was at par with nitrogenous fertilizer 100 g/tree (5.57 cm) as compared to control (4.63 m). Potash failed to show any significant effect on diameter of branch. But the interaction effect of N x K found significant. The combine effect of nitrogen @ 50 g/plant and potash @ 25 g/plant significantly gave higher diameter of branch (5.91 m). It might be due to the application of nitrogen also promotes the vegetative growth and thus, length and diameter of branches might also be favoured due to nitrogen application. These results are in agreement with those of Gupta *et al.* (1999), Yadav *et al.* (2001) and Singh *et al.* (2004).

Weight of pod is narrated in Table 3. The significantly higher pod weight (g) was recorded in pooled data with treatment of nitrogen @ 100 g/plant treatment followed by treatment of nitrogen @ 50 g/plant in pooled. The potash fertilizer treatments and interaction effect found to be non significant.

The treatment of nitrogen fertilizer 100 g/plant increased the length of pod in pooled (51.94 cm) as well as in all the years also. Potash fertilizer failed to increase the length of pod. All the interaction effects were non-significant.

The data on diameter of one pod are presented in Table 4. The diameter of pod significantly increased by application of nitrogenous fertilizer @ 100 g/plant in pooled (1.21 cm) while, all other experimental years showed non significant effect. Potash also failed to improve pod diameter. All the interaction effects were found to be non significant.

The application of nitrogenous fertilizer @ 100 g/plant significantly increased the number of pods in the year 2007 (754.83), 2008 (729.67) and in pooled (607.56) as compared to all other treatments while, it was non

Table 2 : Effect of chemical fertilizers on length of branches (cm) and diameter of branches (cm) in drumstick cv. PKM-1

Treatments	Length of branches (cm)				Diameter of branches (cm)			
	Year			Pooled	Year			Pooled
	2005	2007	2008		2005	2007	2008	
N levels (g/plant)								
N_0	2.77	3.57	3.08	3.14	4.08	4.98	4.83	4.63
N_{50}	3.23	3.77	3.42	3.47	5.15	5.87	5.92	5.64
N_{100}	3.53	4.28	4.22	4.01	5.25	6.05	5.42	5.57
S. E $\pm$	0.151	0.160	0.233	0.107	0.122	0.273	0.283	0.137
C.D. (P=0.05)	0.476	0.504	0.734	0.308	0.386	0.861	NS	0.397
K levels (g/plant)								
K_0	3.09	3.67	3.44	3.40	4.71	5.59	5.22	5.17
K_{25}	3.27	4.08	3.70	3.68	4.94	5.68	5.56	5.39
S. E $\pm$	0.123	0.130	0.190	0.087	0.100	0.223	0.231	0.112
C.D. (P=0.05)	NS	0.411	NS	0.252	NS	NS	NS	NS
Interaction								
Y x N	NS	NS	NS	NS	NS	NS	NS	NS
Y x K	NS	NS	NS	NS	NS	NS	NS	NS
N x K	NS	NS	NS	NS	NS	NS	NS	Sig
Y x N x K	NS	NS	NS	NS	NS	NS	NS	NS
C.V.%	11.64	10.11	15.97	12.79	6.21	11.89	12.86	11.03

NS = Non significant

Table 2.1 : Interaction effect of N x K (pooled) on diameter of branches (cm) in drumstick cv. PKM-1

N x K	K_0	K_{25}
N_0	4.38	4.89
N_{50}	5.38	5.91
N_{100}	5.77	5.38
S.E $\pm$	0.194	
C.D. (P=0.05)	0.561	
C.V. %	11.03	

significant in the year 2005. The potash fertilizer failed to show any effect in increasing the number of pods per tree while, all the interaction effect did not show any significant effect.

The yield of pods per tree (kg) presented in Table 5. It can be seen that the application of nitrogen @ 100 g/ tree significantly increased the yield of pod per tree in all the three years but it was non-significant in pooled data.

Table 3 : Effect of chemical fertilizers on weight of pod (g) and length of pod (cm) in drumstick cv. PKM-1

Treatments	Weight of pod (g)				Length of pod (cm)			
	Year			Pooled	Year			Pooled
	2005	2007	2008		2005	2007	2008	
N levels (g/plant)								
N_0	31.33	35.67	34.17	33.72	39.18	42.17	40.83	40.72
N_{50}	38.00	37.50	35.83	37.11	43.83	51.00	50.00	48.28
N_{100}	39.67	41.17	41.83	40.89	48.50	52.17	55.17	51.94
S. E.$\pm$	2.393	1.388	1.717	1.085	1.412	1.260	1.803	0.871
C.D. (P=0.05)	NS	NS	5.410	3.134	4.450	3.969	5.680	2.516
K levels (g/plant)								
K_0	34.44	37.44	36.22	36.04	43.56	47.56	47.33	46.15
K_{25}	38.22	38.78	38.33	38.44	44.11	49.33	50.00	47.81
S. E.$\pm$	1.954	1.113	1.402	1.886	1.153	1.029	1.472	0.711
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS
Interaction								
Y x N	NS	NS	NS	NS	NS	NS	NS	NS
Y x K	NS	NS	NS	NS	NS	NS	NS	NS
N x K	NS	NS	NS	NS	NS	NS	NS	NS
Y x N x K	NS	NS	NS	NS	NS	NS	NS	NS
C.V.%	16.13	8.92	11.28	12.36	7.89	6.37	9.07	7.87

NS = Non significant

Table 4 : Effect of chemical fertilizers on diameter of pod (cm) and number of pods per tree in drumstick cv. PKM-1

Treatments	Diameter of pod (cm)				Number of pods per tree			
	Year			Pooled	Year			Pooled
	2005	2007	2008		2005	2007	2008	
N levels (g/plant)								
N_0	1.05	1.13	1.15	1.11	300.00	633.17	598.33	510.50
N_{50}	1.12	1.28	1.18	1.19	320.00	693.00	655.00	556.00
N_{100}	1.20	1.25	1.17	1.21	338.17	754.83	729.67	607.56
S. E.±	0.061	0.041	0.038	0.028	14.782	19.582	21.126	10.792
C.D. (P=0.05)	NS	NS	NS	0.080	NS	61.701	66.565	31.166
K levels (g/plant)								
K_0	1.10	1.22	1.16	1.16	315.56	683.67	638.89	546.04
K_{25}	1.14	1.22	1.18	1.18	323.22	703.67	683.11	570.00
S. E.±	0.050	0.033	0.031	0.023	12.069	15.989	17.249	8.812
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS
Interaction								
Y x N	NS	NS	NS	NS	NS	NS	NS	NS
Y x K	NS	NS	NS	NS	NS	NS	NS	NS
N x K	NS	NS	NS	NS	NS	NS	NS	NS
Y x N x K	NS	NS	NS	NS	NS	NS	NS	NS
C.V.%	13.38	8.14	7.98	10.00	11.38	6.91	7.83	8.21

NS = Non significant

Table 5 : Effect of chemical fertilizers on yield of pods per plant (kg) and yield of pods (t/ha) in drumstick cv. PKM-1

Treatments	Yield of pods per plant (kg)				Yield of pods (t/ ha)			
	Year			Pooled	Year			Pooled
	2005	2007	2008		2005	2007	2008	
N levels (g/plant)								
N_0	10.87	24.45	21.77	19.03	17.39	39.12	34.83	30.44
N_{50}	12.88	33.70	24.92	23.83	20.61	53.92	39.87	38.13
N_{100}	13.73	36.72	35.38	28.68	21.97	59.20	54.37	45.18
S. E.±	0.342	1.302	1.044	2.042	0.547	2.084	1.182	2.997
C.D. (P=0.05)	1.078	4.101	3.288	NS	1.725	6.567	3.725	NS
K levels (g/plant)								
K_0	12.04	31.12	25.56	22.91	19.27	49.88	39.41	36.19
K_{25}	12.94	32.26	29.14	24.78	20.71	51.61	46.63	39.65
S. E. ±	0.278	1.063	0.852	0.464	0.447	1.702	0.965	1.330
C.D. (P=0.05)	0.880	NS	2.685	1.339	1.409	NS	3.042	NS
Interaction								
Y x N	NS	NS	NS	Sig.	NS	NS	NS	Sig.
Y x K	NS	NS	NS	NS	NS	NS	NS	Sig.
N x K	NS	NS	NS	NS	NS	NS	NS	NS
Y x N x K	NS	NS	NS	NS	NS	NS	NS	NS
C.V.%	6.71	10.06	9.34	10.10	6.71	10.06	6.73	9.17

NS = Non significant

Table 5.1: Interaction effect of Y x N (pooled) on yield of pods per plant (kg) in drumstick cv. PKM-1

Y x N	N_0	N_{50}	N_{100}
Y_1	10.87	12.88	13.73
Y_2	24.45	33.70	36.92
Y_3	21.77	24.92	35.38
S. E. ±		0.983	
C.D. (P=0.05)		2.839	
C.V. %		10.10	

Table 5.2 : Interaction effect of Y x N (pooled) on yield (t/ ha) in drumstick cv. PKM-1

Y x N	N_0	N_{50}	N_{100}
Y_1	17.39	20.61	21.97
Y_2	39.12	53.92	59.20
Y_3	34.83	39.87	54.37
S. E. ±		1.419	
C.D. (P=0.05)		4.098	
C.V. %		9.17	

Table 5.3 : Interaction effect of Y x K (pooled) on yield (t/ha) in drumstick cv. PKM-1

Y x K	K_0	K_{25}
Y_1	19.27	20.71
Y_2	49.88	51.61
Y_3	39.41	46.63
S. E. ±	1.159	
C.D. (P=0.05)	3.346	
C.V. %	9.17	

Table 6 : Effect of chemical fertilizers on total soluble solids (%) in drumstick cv. PKM-1

Treatment	Year			Pooled
	2005	2007	2008	
N levels (g/plant)				
N_0	12.13	12.15	11.77	12.01
N_{50}	11.75	12.33	11.87	11.98
N_{100}	12.10	12.60	12.40	12.37
S. E. ±	0.391	0.132	0.140	0.145
C.D. (P=0.05)	NS	NS	0.440	NS
K levels (g/plant)				
K_0	11.80	12.29	12.06	12.05
K_{25}	12.19	12.43	11.96	12.19
S. E. ±	0.320	0.108	0.114	0.119
C.D. (P=0.05)	NS	NS	NS	NS
Interaction				
Y x N	NS	NS	NS	NS
Y x K	NS	NS	NS	NS
N x K	NS	NS	NS	NS
Y x N x K	NS	NS	NS	Sig.
C.V.%	7.99	2.62	2.85	5.09

NS = Non significant

The application of potash significantly increased the yield of pod per tree. All the interaction effects were found non-significant except the interaction effect of Y x N. Y x N interaction indicated that in the second year, the higher nitrogen @ 100 g/plant gave higher yield (36.92 kg/tree) followed by nitrogen @ 50 g/plant treatment.

The yield of pods (t/ha) was significantly higher in all three experimental years but it was non significant in pooled data. The maximum yield of pods (59.20 t/ha) was recorded with 100 g nitrogen per tree in the year 2007. The interaction effect N x K and Y x N x K found non significant but the interaction effect Y x N and Y x K found significant. Y x N interaction indicated that in the second year, the higher nitrogen @ 100 g/plant gave higher yield of pods (59.20 t/ha) while, Y x K interaction indicated

Table 6.1 : Interaction effect of Y x N x K (pooled) on total soluble solids in drumstick cv. PKM-1

Y x N	K_0	K_{25}
Y_1 x N_0	11.07	13.20
Y_1 x N_{50}	11.67	11.83
Y_1 x N_{100}	12.67	11.53
Y_2 x N_0	12.03	12.27
Y_2 x N_{50}	12.20	12.47
Y_2 x N_{100}	12.63	12.57
Y_3 x N_0	11.70	11.80
Y_3 x N_{50}	11.93	11.80
Y_3 x N_{100}	2.57	12.23
S. E. ±	0.356	
C.D. (P=0.05)	1.028	
C.V. %	5.09	

that in the second year, the application of potash @ 25 g/ plant gave higher yield of pods (51.61 t/ha). It might have resulted into favourable improvement in growth and yield components. The increase in yield due to nitrogen and potash level was also reported by number of workers Yadav and Yadav (2002), Yadav *et al.* (2003), Yadav *et al.* (2005) and Ansary *et al.* (2006).

The data on TSS (%) was indicated in Table 6. The total soluble solid did not show any significant effect in the year 2005, 2007 and in pooled data. But only in the year 2008, nitrogen @ 100 g/plant was found effective in increasing total soluble solids. Potash fails to increase the total soluble solids. The interaction effect of Y x N x

Table 7 : Economics of chemical fertilizers on drumstick cv. PKM-1

Sr. No.	Treatment combination	Pod Yield (t/ ha.)	Gross realization (Rs.)	Total cost of cultivation (Rs.)	Net return (Rs.)	CBR
1.	N_0K_0	28.58	85740	15664	70076	1 : 5.47
2.	N_0K_{25}	32.30	96900	16678	80222	1 : 6.26
3.	$N_{50}K_0$	36.41	109230	17245	91985	1 : 6.33
4.	$N_{50}K_{25}$	39.86	119580	17559	102021	1 : 6.81
5.	$N_{100}K_0$	43.57	130710	18130	112580	1 : 7.20
6.	$N_{100}K_{25}$	46.79	140370	18444	121926	1 : 7.61

Rate: Selling price of Drumstick Pod –Rs. 3/-per Kg

K was found significant. The application of nitrogen @ 100 g/plant gave highest total soluble solids (12.67 %) in the year 2005 without application of potash.

The data presented in Table 7 indicated that an application of 100 g nitrogen per plant and 25 g potash per plant gave highest net return (Rs. 121926) with 1 : 7.61 CBR in drumstick cv. PKM-1.

The grower of drumstick cv. PKM-1 can apply 100 g nitrogen, 25 g potash and 10 Kg FYM per plant. Among them the half dose of nitrogen, full dose of potash and FYM should be given in first week of May after pruning and remaining half dose of nitrogen in the month of October in drumstick cv. PKM-1 for obtaining higher yield (46.79 t/ ha.) with net return (Rs.1,21,926) and higher CBR (1 : 7.61).

REFERENCES

Ansary, S.H.; Choudhary, J.N. and Sarkar, S. (2006). Post harvest studies of onion grown under different moisture regimes and biofertilizers levels. *Crop Res.*, **31** (3) : 404-407.

Gupta R.P., Sharma, V. P., Singh, D.K. and Srivastava, K.J. (1999). Effect of organic manures and inorganic fertilizers on growth, yield and quality of onion varietyAgrifound Dark Red. *NHRDF Newsletter*, **19** (2-3) : 7-10.

Singh, S., Yadav, P.K. and Singh, B. (2004). Varietal performance of onion under different fertility levels in semi arid conditions. *Curr. Agric*., **25** (1-2) : 95-97.

Vachhani, M.U. and Patel, Z.G. (1993). Effect of nitrogen, phosphorus and potash on growth and yield of onion. *GAU. Res. J*., **19 (1) : 136-137.**

Yadav, B. D., Khandelwal, R. B. and Sharma, Y.K. (2005). Use of biofertilizer in onion. *Indian J. Hort*., **62** (2) : 168-170.

Yadav, R.L., Sen, N.L. and Yadav, B.L. (2003). Response of onion to nitrogen and potassium fertilization under seni arid condition of Rajasthan. *Indian J. Hort.*, **60** (2) : 176-178.

Yadav, R.L., Sen, P.K. and Singh, B. (2001). Effect of nitrogen and potassium on growth and yield of onion cv. PUSA RED. *Haryana J. Hort. Sci*., **33** (3-4) : 308-309.

Yadav, Y.S. and Yadav, B.D. (2002). Effect of organic manure in comparision to recommended dose of manure and fertilizers in onion. *South Indian J. Hort.*, **49** : 160-161.

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