REFERENCES

CATE, R.B. Jr and L.A. NELSON. 1965. A rapid method for correlation of soil test analysis with plant response data. Intern. Soil Testing series. Tech.Bull. No.1 North Carolina State University. Agric. Exp Stan; Releigh.

CATE. R.B. Jr. and L.A. NELSON. 1971. A simple statistical procedure for partioning soil test correlation data in two classes. Soil Sci.Soc. Amer. Proc. 35 : 658-668.

LINDSAY W.L. and W.A. NORWELL. 1987. Development of DTPA soil test for Zn. Cu. Fe and Mn. Soil Sci. Soc. Amer.J. 42: 421-428.

Madras Agric. J., 81(8): 434-436 August, 1994

https://doi.org/10.29321/MAJ.10.A01555

EFFECT OF FERTILIZER APPLICATION ON SOIL AVAILABLE NUTRIENTS, YIELD AND NUTRIENT UPTAKE OF GARLIC IN ACIDIC LATERITE SOILS OF KODAIKANAL

A.SARAVANAN and K.M.P. NAMBISAN

Horticultural Reseach Station, Kodaikanal.

ABSTRACT

Graded levels of N (0,50,100 and 150 kg ha^{-1}), P(0,25,50 and 75 kg ha^{-1}) and K(0,25,50 and 75 kg ha^{-1}) in selected combinations were tried as treatments besides application of zinc sulphate in the soil at 12.5 and 25 kg ha^{-1} and foliar spray at 0.5% in fractional factorial design. The two year results revealed that increased doses of application of N,P and K increased the garlic bulb yield and also the uptake of the respective nutrients. Graded levels of the major nutrients also increased the available nutrient content in the soil. A judicious combination of 100-75-50 kg NPK ha^{-1} and soil application of 100-75-50 kg NPK ha^{-1} and soil application of $ZnSO_4$ at 25 kg ha^{-1} was found to be the optimum to get high yield (upto 20%), nutrient uptake by the crop besides maintaining the soil fertility in terms of availables major nutrient contents under the conditions of acidic leteritic soils of Kodaikanal

Garlic (*Allium sativum* L.) is one of the bulb spice crops grown under wide agroclimatic conditions throughout India. It prefers a moderately cool mean temperature during the growing season. The upper Palani hills, a spur of the Western Ghats situated at 1500 m above MSL is suited for its cultivation. In the acidic laterite soils of this hill, the area under garlic crop is fast increasing. Although garlic can be grown on a variety of soils, proper nutrition management is considered essential. Standardising the fertilizer schedule to obtain economic returns was felt to be an urgent need. Field experiments were conducted in 1991 and 1992 at Kodaikanal.

Table 1. Initial soil analysis of the experimental field.

Properties	
Texture	Sandy loam
pH	5.3
E.C (m.mhos/cm)	0.12
CEC (me/100 g)	14.40
Available N (kg ha^{-1})	210
Available P (kg ha^{-1})	10.5
Available K (kg ha^{-1})	220
DTPA - Zn (ppm)	1.0

MATERIALS AND METHODS

The basic soil properties of the experimental field are furnished in Table 1. The treatments were 4 levels of N (0,50,100 and 150 kg ha^{-1}), 4 levels of P(0,25,50 and 75 kg ha^{-1}) and $ZnSO_4$ as basal soil application at 12.5 and 25 kg ha^{-1} besides foliar

Table 2. Effect of fertilizers on bulb yield of garlic (kg ha^{-1}).

Treatments	1991	1992	Mean
$N_0P_{50}K_{50}$	7625	8563	8094
$N_{50}P_{50}K_{50}$	8375	9000	8688
$N_{100}P_{50}K_{50}$	9188	9263	9225
$N_{150}P_{50}K_{50}$	9563	9813	9688
$N_{100}P_0K_{50}$	8520	9375	8813
$N_{100}P_{25}K_{50}$	8250	9500	8875
$N_{100}P_{50}K_{50}$	9438	9563	9500
$N_{100}P_{75}K_{50}$	9625	9875	9750
$N_{100}P_{50}K_0$	9625	9875	9750
$N_{100}P_{50}K_{25}$	8250	9813	9031
$N_{100}P_{50}K_{50}$	9313	9875	9594
$N_{100}P_{50}K_{75}$	9563	9875	9719
$N_{100}P_{50}K_{50}$ + 12.5 $ZnSO_4$	9438	9625	9531
$N_{100}P_{50}K_{50}$ + 25 $ZnSO_4$	9625	9875	9750
$N_{100}P_{50}K_{50}$ + $ZnSO_4$ spray	9000	9313	9156

CD at 5% : Year : 173. Treatment : 472 Year x Treatment : NS

Table 3. Effect of fertilizers on uptake of nutrients by garlic bulb (kg ha^{-1}).

Treatments	Uptake of N (kg ha^{-1})			Uptake of P (kg ha^{-1})			Uptake of K (kg ha^{-1})		
	1991	1992	Mean	1991	1992	Mean	1991	1992	Mean
$N_0P_{50}K_{50}$	153	167	160	305	38.5	34.5	137	150	144
$N_{50}P_{50}K_{50}$	188	180	184	33.5	40.5	37.0	167	167	159
$N_{100}P_{50}K_{50}$	207	185	196	41.3	37.1	39.0	170	176	178
$N_{150}P_{50}K_{50}$	215	196	206	43.0	39.3	41.2	186	162	184
$N_{100}P_0K_{50}$	186	183	185	33.0	37.5	35.3	153	173	163
$N_{100}P_{25}K_{50}$	186	185	186	37.1	42.8	40.0	153	176	165
$N_{100}P_{50}K_{50}$	219	191	205	49.1	43.0	46.1	175	177	176
$N_{100}P_{75}K_{50}$	223	193	208	50.1	49.4	49.7	178	178	178
$N_{100}P_{50}K_0$	217	198	208	38.5	39.5	39.0	173	178	176
$N_{100}P_{50}K_{25}$	191	221	206	37.1	44.2	40.7	153	186	170
$N_{100}P_{50}K_{50}$	228	247	238	48.4	44.4	46.4	191	198	195
$N_{100}P_{50}K_{75}$	241	247	244	49.7	44.4	47.1	206	198	202
$N_{100}P_{50}K_{50}$ + 12.5 $ZnSO_4$	213	193	212	37.8	38.5	38.2	170	183	177
$N_{100}P_{50}K_{50}$ + 25 $ZnSO_4$	236	198	217	38.5	44.4	41.5	173	188	181
$N_{100}P_{50}K_{50}$ + $ZnSO_4$ spray	221	182	202	36.0	41.9	39.0	162	177	170
Critical difference at 5%			33			8.0			17

spray at 0.5% during its vegetative phase. The selected combinations of NPK and $ZnSO_4$ treatments totalling 15 were replicated twice in fractional factorial design. The garlic cloves were sown at 30 x 10 cm spacing in 4 m^2 plots. The fertilizers supplying P, K and Zn were applied basally while half the quantity of N was added as basal and the remaining half dose was top dressed at 45 days after sowing. Regular cultural practices were followed. At harvest, the samples of bulb were analysed for nutrient content and then for the uptake computations. (Piper, 1966) The soil samples collected after harvest were analysed (Jackson, 1973) for available nutrient content. The yield data, the data on nutrient uptake and soil available nutrients were subjected to statistical processing (Snedecor and Cochran, 1967).

RESULTS AND DISCUSSION

The mean yield varied between 8094 and 9750 kg ha^{-1} for various treatments, the highest being 9750 kg ha^{-1} for the plots receiving 100-75-50 kg of NPK. (Table 2). Garlic response generally well to the added N. Addition of increased doses of N correspondingly increased the bulb yield significantly over its lower doses, the gain in yield being 7.14 and 20 per cent respectively for 50, 100 and 150 kg ha^{-1} levels. Nitrogen as a growth element would have helped the increased biomass production in a lateritic sandy soil having low available N status. Similarly graded levels of P application resulted in increased yield of bulb to the tune of 10 per cent. The beneficial effect of P up to 300 kg ha^{-1} was earlier reported by Ramierz *et al.* (1973). However, a combination of 100-75-50 kg NPK ha^{-1} was found to give high yield as compared with the other combinations. Foliar spray of this micronutrient was earlier also observed to be ineffective in a similar situation (Gnon, 1984). The response to the soil application could be attributed to the initial low soil status of this mineral (Table 1).

Garlic removes large quantities of nutrients from the soil. The data on uptake of N by garlic bulb (Table 3) showed higher values of treatment 100-50-50 kg NPK +25 kg $ZnSO_4$ ha^{-1}. This was also reflected the superior bulb yield obtained in response to this dosage. As could be expected rising levels of applied N increased the uptake of N by bulbs significantly while the application of P or Zn had little influence on uptake. Enhanced doses of N application would have resulted in high soil available N ultimately leading to higher biomass production and N utilisation. The sharp increases in available N recorded at the post-harvest stage also lent support to this surmise. Higher doses (50 and

Table 4. Effect of fertilizers on soil available nutrients.

Treatments	available N (kg ha^{-1})			available P (kg ha^{-1})			available K (kg ha^{-1})		
	1991	1992	Mean	1991	1992	Mean	1991	1992	Mean
$N_0P_{50}K_{50}$	222	229	225	28.8	29.5	29.1	248	255	251
$N_{50}P_{50}K_{50}$	234	262	248	28.8	29.5	29.1	268	273	270
$N_{100}P_{50}K_{50}$	269	279	274	29.0	30.7	29.9	288	290	289
$N_{150}P_{50}K_{50}$	284	288	286	29.4	31.0	30.2	300	303	301
$N_{100}P_0K_{50}$	244	246	245	31.1	30.2	30.6	258	263	260
$N_{100}P_{25}K_{50}$	255	252	254	34.5	33.5	34.0	268	273	270
$N_{100}P_{50}K_{50}$	266	258	262	37.2	36.4	36.8	268	273	270
$N_{100}P_{75}K_{50}$	268	274	271	41.3	38.5	39.9	268	273	270
$N_{100}P_{50}K_0$	252	254	253	32.5	31.5	32.0	258	273	265
$N_{100}P_{50}K_{25}$	252	257	255	31.7	30.7	31.2	288	293	290
$N_{100}P_{50}K_{50}$	258	258	258	32.0	31.5	31.8	308	303	305
$N_{100}P_{50}K_{75}$	264	260	262	32.5	32.0	32.3	338	323	330
$N_{100}P_{50}K_{50}$ + 12.5 $ZnSO_4$	261	253	257	31.5	32.0	31.8	358	255	256
$N_{100}P_{50}K_{50}$ + 25 $ZnSO_4$	264	252	258	33.5	32.0	32.8	258	255	256
$N_{100}P_{50}K_{50}$ + $ZnSO_4$ spray	258	252	255	33.5	32.0	32.8	258	255	256
Critical difference at 5%	Year : 2 treatment : 4 Year x treatment : 4			Year : NS treatment : 1.8 Year x treatment : NS			Year : Not significant treatment : 20 Year x treatment : Not significant		

75 kg ha^{-1}) of K had a positive influence on uptake was established by earlier workers also (Manickam and Ramaswamy, 1987), Increased uptake of P was noted for the highest level (75 kg ha^{-1}) of application of P. The uptake of P by garlic bulb was not influenced significantly by increasing the levels of N, K and Zn. As in N and P the uptake of K by bulb was found to be enhanced by increased levels of application of K upto 50 kg level. Application of added doses of N increased the uptake of K also.

The available soil N estimated at post-harvest stage of the crop was favourably influenced by graded levels of N or K applications. It was on anticipated line that the higher doses of applied N have resulted in a rise in available N in the soil. The favourable effect of K on available N might be explained as a replacement phenomenon due to their similarly in ionic radii.. As expected, the increased doses of P added through the fertilizer source resulted enhanced availability of P. Similar to the behaviour of N or P, application of K in graded levels increased the available K content significantly.

REFERENCES

ANON 1984. Final Report, Western Ghat Devpt. Scheme, Horticultural Research Station, Kodaikanal.

JACKSON, M.L. 1973. **Soil Chemical Analysis**, Prentice Hall of India, New Delhi.

MANICKAM, T.S. and RAMASWAMY, P.P. 1987. Fate of Fertilizer Nitrogen, Tech.Volume, Indo-US Project, TNAU, Coimbatore.

PIPER, C.S. 1966. **Methods of Chemical Analysis**, Oxford Univ.Press, New York.

RAMIERZ, H.V.E., LOPEZ, G.C.A. and LORIA, M. 1973.**Proc.Trop.Region, Amer.Soc.Hort.Sci.17**:247-54.

SNEDECOR and COHRAN 1967. **Statistical Methods.** The Iona State Unit Press, USA.