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SHORT COMMUNICATION

Integrated nutrient management in lemon (*Citrus limon* Burm) cv. pant lemon-1

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Citrus occupies an important position in fruit industy on account of its great utility. In *Tarai*, lemon has been found to be the most successful fruit due to its adaptability and availability of fruits throughout the year. among several cultivars grown, Pant Lemaon-1 is the most promising in *Tarai* condition of Uttarakhand.it is a singal plant selection from "Kagzi kalan Lemon" (Baldevraj, 1990). It bears flowers and fruits in two main flushes and exhausts more nutrients to maintain vegetative growth which can support flowering and fruiting. To meet the requirement of nutrients recommended for different fruit crops, it could be either is supplied through inorganic source, but each one has its limitations. For meeting nutrient requirement, a recent emphasis has been given on the integrated nutrient management (INM). Integrated nutrient management is the combined use of organic and inorganic fertilizers and relies on use of FYM, crop residuse, legumes, biofertilizers, biopestisides. Looking into the importance of nutrient management, the present expriment "Integrated nutrient management in lemon cv. Pant Lemon-1" was planned to study the effect of Integrated nutrient management on yield and quality of lemon.

The study was conducted during 2006-2007 at Horticultural Research Centre, Patharchatta of G.B.P.U.A.&T., Pantnager, U.S. Nager (Uttrakhand) on eight year old uniform plants of lemon *(Citrus limon* Burm) cv. Pant Lemon-1. The planting distance was 5m x5m. All the trees were maintained under uniform cultural treatments during the course of investigation. The experiment was laid out in randomized block design (R.B.D) with fifteen treatment and three replications. The different treatment were as T_1=400g(N)+250 g(P)+400g(K) $T_2=T_1+0.25\%$ $ZnSO_4$ spray,$T_3 = T_1 + 0.5\%$ $ZnSO_4$ spray,$T_4 = T_1 + 1.0\%$ $ZnSO_4$ spray, $T_5 = T_1 + 0.1\%$ $CUSO_4$ spray,$T_6 = T_1 + 0.2\%$ $CUS0_4$ spray,T_7 =1/2 dose T_1 + 20 kg FYM,T_8 = 1/2 dose T_1 + 20 kg vermicompost,T_9 = 1/2 dose T_1 + 20 kg FYM, T_8 + 60 g Trichoderma, T_{10} = 1/2 dose T_1+ 20 kg FYM + 100 g Trichoderma. T_{10} = 1/2 dose T_1 + 20 kg FYM + 140 g Trichoderma,T_{12} = 1/2 dose T_1 + 20 kg vermicompost + 60 g *Pseudomonas*. T_{13} = 1/2 dose T_1 + 20 kg vermicompost + 100 g *Pseudomonas*.T_{14} =1/2 dose T_1 + 20 kg vermicompost + 140 g *Pseudomonas*, TIS = Control.

Trichoderma (60, 100 and 140g) was mixed with well rotten FYM (20 kg) two weeks before application in field and *Pseudomonas* (60, 100 and 140g) was mixed in vermicompost (20 kg) five days prior to field application. The treatments were given in the month of April. FYM, Trichoderma, vermicompost and *Pseudomonas*. they were mixed thoroughly and before application a ring was made around the plant (60 ctn. away from the stem). Respective doses of fertilizers were mixed thoroughly into 20 cm top soil. The data on yield, physical parameters and chemical parameters were recorded. The experiment was laid out in Randomized Block Design (RBD) as described by Snedecar and Cochran (1987) and each treatment replicated thrice.

It appear from the data in Table 1 that trees treated with 200 g N + 125 g P + 200 g K + FYM 20 kg (T 7) dose of nutrients significantly improved fruit yield (kg/tree). These results are in accordance with that of Beridze (1990) who found that the highest yield of 6.6 t/ha was obtained from lemon trees receiving 150 kg N + 120 kg P + 80 kg K ha basal dressing + FYM at 25 t/ha. Increase in yield due to FYM application may be attributed to better uptake of nutrients in addition to better water uptake. Similar results were also reported by Salik *et al,* (2000) who noted highest yields from trees receiving NPK + FYM in case of mandarin trees. The data regarding average fruit weight are presented in Table 1. Fruit weight was significantly influenced by treatments. Among different treatment combinations T_9 (1/2 dose T1) + 20 kg FYM + 60g *Trichoderma*) gave maximum average fruit weight. Our results are in conformity with the study of Patil et al. (2004) who reported highest average fruit, weight due to application of 50% recommended dose of fertilizer + 50% FYM. The minimum peel thickness was found in fruits with T3 (400g N +250g P + 400g K + 0.5% ZnS04 spray). Our results are in accordance with findings of Deshraj (1989) who found that peel thickness was reduced by highest level of nitrogen along with highest level of phosphorus.

A perusal data in Table 2 reveal that treatments had significant effect on per cent juice content. Maximum fruit juice content was found with the application of T_4 (400g N +250g P + 400g K + 1% ZnS04 spray). These re-

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sults were also experimentally supported by Sharma *et al.* (2003); Langthasa and Bhattacharya (2004) who reported maximum juice content with 0.5% ZnS04 spray. Dixit *et al.* (1977) and Malik *et al.*, (2000) also reported significant improvement by ZnSO4 application.

The plants which were supplemented by 200g N + 125g P + 200g K + 20 kg FYM (T_7) produced maximum T.S.S. These results are supported by Soorihanathasundrama *et al.*, (2001) who found maximum TSS (26.0%) with 25% FYM and 75% inorganic N as urea as compared to control. The higher TSS might be due to the improvement in the metabolic and enzymatic activity during fruit formation and maturity, which might have triggered the processes related to quality as reported by Khan *et al.*, (2004). The trees receiving T_{12} (1/2 dose T_1 + 20 kg FYM + 140g *Trichoderma)* dose of nutrients gave maximum acidity. These findings are in agreement with the results obtained by Chaudhary *et al* (1975) who reported that the application of 45 kg FYM and higher dose of NPK per tree increased acidity as compared to control in guava fruits. Maximum acidity was found from the fruits under highest dose of nitrogen. Similar results have been made by Pomares *et al.* (1983) and Dilipbabu (1984) who reported that nitrogen and potassium gave maximum acidity in all flushes of fruits.

Maximum ascorbic acid (50.27 mg/loog) was found by the application of 200g N + 125g P + 200g K + 20 kg FYM (T_7). These results are supported by Patil *et al.* (2004) who stated that ascorbic acid content (26.76 mg / l00g) was highest with 50% recommended dose of fertilizer + 50% FYM. FYM improves soil structure, infiltration rate, water holding capacity and available nutrient status of soil. Similar results were obtained by Chaudhary *et al.* (1975) and Ingle *et al.*, (2001). The improvement in quality of fruit may be due to improvement in the soil physical properties, water holding capacity, structure, porosity, bulk density, hardiness, chemical properties like nutrient status, soil pH, hormone and biological properties like bacteria, fungi, actinomycetes and earthworm activity in soil (Chattopadhaya, 1994).

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Table 1. Effect of integrated nutrient management on physical characteristics on lemon cv. Pant Lemon-1.

Treatment	Fruit retention (%)	Avg. number of fruit/tree	Avg. fruit weight (g)	Fruit yield (kg/tree)	peel thickness of fruit (mm)
T_1 N400 + P2S0 + K400 g/tree	33.48	59.85	84.33	5.87	2.238
T_2 T_1 + 0.25% ZnS04 spray	29.17	70 50	81.22	6.72	2.316
T_3 T_1 + 0.5% ZnS04 spray	30.29	66.50	83.83	6.91	2.158
T_4 T_1 + 1.0% ZnS04 spray	41.97	78.73	85.56	7.34	2.200
T_5 T_1 + 0.1 % CUS04 spray	35.14	61.04	84.66	5.58	2 356
T_6 T_1 + 0.2% CUS04 spray	37.32	79.34	86.51	7.00	2.035
T_7 1/2dose TI + 20 kg FYM	39.97	91.16	91.59	9.66	2.155
T_8 1/2dose T_1 + 20 kg Ver.	39.73	80.05	89.14	7.38	2.140
T_9 1/2dose T_1 + 20 kg FYM + 60 g Tr.	30.75	83.18	98.10	8.32	2 171
T_{10} 1/2dose T_1 + 20 kg FYM + 100 g Tr.	37.01	83.58	94.86	9.39	2.238
T_{11} 1/2 dose T_1 + 20 kg FYM + 140 g Tr.	38.88	80.94	91.07	8.71	2 046
T_{12} 1/2dose TI + 20 kg Ver. + 60 g *P. f*	40.78	86.06	89.53	8.96	2.161
T_{13} 1/2 dose T_1 + 20 kg Ver. + 100 g *P. f*	41.24	87.39	90.78	6.43	1.995
T_{14} 1/2 dose T_1 + 20 kg Ver. + 140 g *P. f*	41.94	70.15	89.24	8.07	1.851
T_{15} Control	24.32	57.42	78.15	4.86	2.371
CD at 5%	5.05	10.789	9.814	1.0644	0.241

Ver. = Vermicompost, *Tr.* = *Trichoderma, P.f.* = *Pseudomonas fluroscense*

Table 2. Effect of integrated nutrient management on chemical character of lemon cv. Pant Lemon-1

Treatment	Fruit juice (%)	TSS (Brix)	Acidity (%)	Ascorbic acid (mg/100 ml juice)
T_1 N400 + P2S0 + K400 g/ tree	27.72	5.71	4.86	48.60
T_2 T_1 + 0.25% ZnS04 spray	28.40	5.58	4.91	49.55
T_3 T_1 + 0.5% ZnS04 spray	28.03	5.54	4.87	49.82
T_4 T_1 + 1.0% ZnS04 spray	29.90	5.69	4.68	49.61
T_5 T_1 + 0.1 % CUS04 spray	28.03	5.44	4.87	49.73
T_6 T_1 + 0.2% CUS04 spray	29.11	5.31	4.89	50.15
T_7 1/2 dose T_1 + 20 kg FYM	27.39	6.19	4.93	50.27
T_8 1/2 dose T_1 + 20 kg Ver.	28.72	5.55	5.09	50.02
T_9 1/2 dose T_1 + 20 kg FYM + 60 gTr.	29.86	5.55	5.09	49.73
T_{10} 1/2 dose T_1 + 20 kg FYM + 100 g Tr.	28.09	5.33	5.05	50.02
T_{11} 1/2 dose T_1Tl + 20 kg FYM + 140 g Tr.	29.14	5.25	5.10	49.90
T_{12} 1/2 dose T_1 + 20 kg Ver. + 60 g *P.f.*	29.60	5.38	5.49	50.15
T_{13} 1/2 dose T_1 + 20 kg Ver. + 100 g *P.f.*	29.38	5.38	5.20	50.05
T_{14} 1/2 dose T_1 + 20 kg Ver. + 140 g *P.f.*	29.29	5.44	5.17	50.41
T_{15} Control	26.98	6.15	4.95	47.85
CD at 5%	0.940	0.4174	0.306	NS

Ver. = Vermicompost, *Tr.* = *Trichoderma*, *P.f.* = *Pseudomonas fluroscense*

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