

<http://www.pjbs.org>

**PJBS**

ISSN 1028-8880

# **Pakistan Journal of Biological Sciences**

**ANSI***net*

Asian Network for Scientific Information  
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

## Effect of Time of Fertilizer Application on the Productivity of Kinnow (*Citrus reticulata* Blanco)

M. Raza Salik, <sup>1</sup>Faqir Muhammad and M. Amin Shakir  
Horticultural Research Station, D.G. Khan, <sup>1</sup>Agriculture College, D.G. Khan, Pakistan

**Abstract:** Present studies were conducted to evaluate the effect of fertilizer application at different times of the year on the productivity of kinnow. 40 kg rotted farm yard manure, 1 kg urea, 4 kg single super phosphate and 1 kg sulphate of potash per plant was applied at three different times i.e., in January, April and July. Application in January improved the number of fruits, fruit size, weight of fruit and juice contents during 1997-98. TSS and juice percentage was not affected by any treatment. The same trend for effect of fertilizers was also observed during 1998-99 with a difference only that juice percentage was also affected with fertilizer treatment and increased when the fertilizer was applied in January. When the fertilizers were applied in April or July, no improvement was noted and the results were similar to or worse than control.

**Key words:** Kinnow, *Citrus reticulata*, fertilizers, farm yard manure, time of application, productivity

### Introduction

Kinnow (*Citrus reticulata* Blanco) is an important member among citrus fruits. It is the heaviest bearer than any other citrus fruit. It is very much liked by all sorts of people due to its excellent taste, dietary values, rich in vitamin-C, large amount of juice and melting juice vesicles. Citrus occupies the first position in fruit industry with regard to its area and production in Pakistan and kinnow shares the major part of this area and production. Area under citrus is 196.1 thousand hectares, out of which kinnow is planted on 17.9 hectares (Anonymous, 1998).

Unfortunately, the production from kinnow orchards is very low than standard. There are so many reasons for this low yield but fruit drop, alternate bearing insufficient plant protections and non judicious use of fertilizers are major limitations. Fertilizers are being used by the growers at any time of the year without knowing the proper time at which the fertilizer may improve the crop more effectively and its impact on yield.

A fertilizer trial was carried out on 7 year old mandarin (*Citrus reticulata*) cv. Local. N at 0, 50 or 100 g/plant and P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O each at 0 or 50 g/plant were applied in the last week of January and last week of April each year. The highest yield and the greatest plant spread (4.4 m N-S and 4.6 m E-W) were obtained with 100 g N + 50 g P<sub>2</sub>O<sub>5</sub> + 50 g K<sub>2</sub>O applied in January. The largest fruit weight (147 g) was also obtained with this treatment. The stem girth was largest with 50 g N + 50 g P<sub>2</sub>O<sub>5</sub> + 50 g K<sub>2</sub>O. The treatments had no significant effect on fruit diameter and quality (Sharma and Azad, 1991). An experiment was conducted on satsuma mandarin to observe the effect of fertilizers on fruit quality and yield. Soil OM content was 1.02-1.13%. N was applied at 0.038-0.045%, P<sub>2</sub>O<sub>5</sub> at 0.030-0.024% and K<sub>2</sub>O at 0.88-1.02%. Different combinations and rates of N, P, K and lime were applied at different times. Results showed that P application had no effect on yield but the combined application of NPK before the initiation of new growth in February increased yield by 28.5% but fruit acidity was increased. Applying lime powder at 2250 kg/ha increased yield by 37.2% and had a good effect of fruit quality (Meng *et al.*, 1992). In experiments with 18 year old Weizhang satsuma mandarin trees, Biquan (a foliar applied fertilizer, produced in Taiwan) was applied at different times and at different concentrations. Shoot growth, leaf chloroplast content and the photosynthetic rate of the leaves were measured. Fruit quality was also evaluated. Results showed that application 1-3 times (at the pre-flowering stage, at the time of physiological fruit drop and during the period of fruit let swelling), all had positive

effects on the shoot growth, leaf chloroplast content and photosynthetic rate. The soluble solids content of the fruits of sprayed trees was increased by 1.5-1.9% and the fruits were of better colour and had a richer flavour with increased yield (Shi *et al.*, 1992). Different combinations of NPK were applied before flowering, after fruit setting and during fruit bud differentiation. It was noted that yield, fruit size and quality was improved with the application before flowering (Ronetz, 1993).

Keeping in view the above mentioned facts this project was initiated to find the effect of time of fertilizer application on kinnow productivity.

### Materials and Methods

Present studies were carried out at Horticultural Research Station, Dera Ghazi Khan during 1997 to 1999. There were three treatments and four replications thus twelve plants of kinnow were selected for the studies. One more plant was selected to serve as control. The plants were growing under similar agroclimatic conditions and were uniform in size and age. The age of the plants was round about 10 years. Various treatments were as under:

T<sub>1</sub> = Control      T<sub>2</sub> = Application of fertilizer in January  
T<sub>3</sub> = Application of fertilizer in April  
T<sub>4</sub> = Application of fertilizer in July

The dose of fertilizer used per tree was as:

(i) Farm yard manure = 40 kg      (ii) Urea = 1 kg  
(iii) SSP = 4 kg      (iv) SOP = 1 kg

The farm yard manure and fertilizers were applied as a single dose as combined application. Same dose was repeated three times a year i.e., January, April and July. In case of January and April treatments, nitrogen was applied in two split doses. Data on the following parameters were recorded:

1 Number of fruits	2 Fruit size (cm) <sup>2</sup>
3 Average weight per fruit (g)	4 T.S.S.
5 Juice contents	6 Juice percentage

The experiment was laid out according to the randomized complete block design. The treatment means were compared for their significance by Duncan's Multiple Range test with the method described by Steel and Torrie (1980).

### Results and Discussion

Nearly same trend was noted in the results of 1997-98 and

Table 1: Effect of time of fertilizer application on the productivity of kinnow (*Citrus reticulata* Blanco.) in 1997-98

Treatment	No. of fruits	Fruit size (cm <sup>2</sup> )	Avr. Wt. of single fruit (g)	T.S.S.	Juice contents (ml)	Juice percentage
T <sub>1</sub>	470.1b	27.03b	168.3b	5.1a	91.8b	54.56a
T <sub>2</sub>	493.3a	29.07a	186.3a	5.1a	105.3a	56.87a
T <sub>3</sub>	402.5c	25.48bc	162.5c	6.1a	89.1c	54.82a
T <sub>4</sub>	471.1b	26.32b	163.2c	5.2a	92.4c	56.70a

Table 2: Effect of time of fertilizer application on the productivity of kinnow (*Citrus reticulata* Blanco.) in 1998-99

Treatment	No. of fruits	Fruit size (cm <sup>2</sup> )	Avr. Wt. of single fruit (g)	T.S.S.	Juice contents (ml)	Juice percentage
T <sub>1</sub>	638.1b	27.07b	183.40c	5.2a	101.1b	55.3ab
T <sub>2</sub>	657.7a	29.68a	193.70a	5.2a	111.5a	61.7a
T <sub>3</sub>	523.8c	24.26bc	187.30b	5.1a	99.1c	53.6b
T <sub>4</sub>	499.6d	27.11b	181.05c	5.2a	96.2c	49.8b

1998-99 for various reproductive characters. Some factors of fruit were affected as a result of fertilizer application showing significant difference while others remained unaffected. The factors which gave significant difference are discussed as under:

**Number of fruits per plants:** Table 1 and 2 depict significant results for various treatments. T<sub>2</sub> got the highest position by producing 493.3 fruits in 1997-98 and 657.7 in 1998-99. The lowest number of fruits was found in T<sub>3</sub> during 1997-98 and 499.6 fruits in T<sub>4</sub> during 1998-99. Control gave better fruiting 470.1 and 638.1 in 1997-98 and 1998-99 than other treatments except T<sub>2</sub>.

**Fruit size (cm)<sup>2</sup>:** Significant difference among various treatments was observed (Table 1, 2). T<sub>2</sub> produced the maximum sized fruits. The next best treatment was T<sub>4</sub> which was similar to control statistically (27.03 cm<sup>2</sup> in 1997-98 and 27.07 cm<sup>2</sup> in the next year). T<sub>3</sub> was found at the bottom in both the years producing 25.48 and 24.26 cm<sup>2</sup> sized fruits in first and second year, respectively.

**Average weight of single fruit:** T<sub>2</sub> maintained its superiority over all other treatments as revealed by Table 1 and 2. It produced a fruit of 186.3 and 193.7 g on average basis during 1997-98 and 1998-99, respectively. The control was found somewhat better than remaining treatments by producing 168.3 and 183.4 g fruits in 1997-98 and 1998-99. Other treatments did not show promising results. T<sub>3</sub> and T<sub>4</sub> produced one fruit with average weight of 162.5 and 163.2 g in 1997-98 and 187.3 and 181.05 g during 1998-99, respectively.

**Total soluble solids:** No treatment could affect the amount of total soluble solids and their concentration was noted similar in treated and untreated plants. No statistical difference could be located among them as is depicted in Table 1 and 2.

**Juice contents (ml):** As a tradition, T<sub>2</sub> superseded all other treatments and significant differences were noted in various treatments (Table 1 and 2). T<sub>2</sub> gave 105.3 and 111.5 ml juice in both the years respectively. Next position was occupied by control which produced 91.8 and 101.1 ml juice in two consecutive years. T<sub>3</sub> and T<sub>4</sub> were found statistically similar

in both the years and produced juice contents of 89.1 and 92.2 ml in 1997-98 and 99.1 and 96.2 ml during 1998-99, respectively.

**Juice percentage:** Juice percentage was not affected by any treatment during 1997-98 and all the treatments including control behaved alike (Table 1). However, during 1998-99, a difference in treatment means was noted. Maximum juice percentage was found in T<sub>2</sub>. The remaining treatments were statistically similar and the juice percentage was 55.3, 53.6 and 49.8% in T<sub>1</sub>, T<sub>3</sub> and T<sub>4</sub>, respectively.

## Discussion

The results of the experiment explained that fertilizers and manures must be applied to citrus in January to have maximum improvement in the production. If the fertilizer is to be applied at other times of the year i.e., April or July, it will not help to enhance the yield, rather than its negative effects may reduce the production. The results of the present studies are according to the findings of Meng *et al.* (1992), Sharma and Azad (1991) and Ronetz (1993).

## References

- Anonymous, 1998. Agricultural Statistics of Pakistan 1997-98. Agriculture and Livestock, Economics Wing, Islamabad, Pakistan.
- Meng, C.F., M.F. Zhou and J.S. Zhou, 1992. Effect of applying phosphorus, potassium fertilizers and lime in red soil orchards on yield and fruit quality of *Satsuma mandarin*. China Citrus, 20: 3-6.
- Ronetz, B.C., 1993. Growth and productivity of mandarins as affected by the time of fertilizer application. Fort. Res., 6: 221-227.
- Sharma, R.C. and A.S. Azad, 1991. Effect of different levels of NPK on growth, yield and quality of madarin. Indian J. Hortic., 48: 116-120.
- Shi, X., S.Y. Li, M.E. Ye, Z.X. Ying and J.L. Chen, 1992. Effect of Biquan plant health growth substance on the growth and fruit quality of *Satsuma mandarin*. China Citrus, 21: 39-40.
- Steel, R.G.D. and P.A. Torrie, 1980. Principles and Procedures of Statistics. McGraw-Hill, New York, pp: 377-444..