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EFFECTS OF FERTILIZERS ON FRUIT SETTING, DROP AND YIELD IN KINNOW MANDARIN

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The project was started in 1974-75 to study effects of fertilizers carrying N.P and K elements on the performance of Kinnow mandarin. The effects on fruit setting, drop and yield, studied during the years 1974–75 & 1975-76 are reported. During first year, the fruit setting was not affected significantly by fertilizer treatments but in the second year (1976) a tendency of increase in fruit set on the treated trees was noted. Total fruit drop also seemed to be un-affected but the periodical drop during the season showed variable effects of fertilizers. The treatment of Urea and the combined treatments of urea, superphosphate and potassium sulphate gave higher yield than others. Moreover, there was also indication of 10—36% improvement of yield in 1976 over 1975 with many fertilizer treatments and no such increase was noted in control trees.

INTRODUCTION

The citrus industry of the province has made phenominal progress in acreage since the creation of Pakistan. But the production per unit area has not shown any significant increase, with the result the yield per acre is far from satisfactory. The primary factor for this low production is probably poor nutrition. The fruit industry of the province is as old as 40 years but its nutritional aspects has not so far received due attention, consequently a productive fertilizer programme of citrus orchard is still lacking. The present project was envisaged to study some aspects of the nutritional problem as related to our conditions by using some new complex fertilizers which have recently appeared in the market. Since the present concept of manurial nutrition implicate the use of all three major elements i.e. N, P & K in fertilizer programme, the complex fertilizers are choosen as source material in the present project.

The experiments of Parker and Jones (1951) on citrus trees in California, Singh, Singh and Khan (1945) at Lyallpur and many others have brought out that nitrogen should be regularly maintained at optimum level and its source should be both from chemical fertilizers and organic manures. It is beneficial to apply total nitrogen in two or more doses rather than one dose. Besides

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yield responses to nitrogen application, physical and chemical characters of the fruit are also affected. High nitrogen levels have been reported to reduce fruit size and less degree of colouration in oranges and has depressing effects on fruit quality (Reitz & Koo, 1960).

Phosphorus application as fertilizer may or may not have effect on yield but it does influence the fruit characters. Champman and Rayner (1951) found that phosphorus in sufficient amounts tends to reduce average fruit size, results in thin rind of smooth texture, lowers the acidity, soluble solids and vitamin C, increases the juice contents and makes the fruit more firm. The phosphorus deficient trees show greater pre-harvest drop.

Like phosphorus, effects of potash fertilizers on fruit yield are not commonly found, but the size, colour and composition of the fruit are changed. Increase in potash levels in leaves is accompanied by increased fruit size in Valencia late Orange (Smith and Rasmussen, 1959), improved fruit colour, increased acidity and decreased total soluble solids but increased vitamin C content of the fruit (Anonymous, 1959).

Marsanija (1971) reported that the growth and yield of lemon trees were greater with NPK than after farm yard manure application. The results of his studies indicated that whereas half, one and two levels (unspecified) of NPK resulted 89, 147 and 167 per cent higher yield respectively, one and two levels of farm yard manure gave 73 per cent and 169 per cent higher yields respectively, than the control. The combined use of one and two levels of each of NPK and farm yard manure resulted in 162 and 222 per cent higher yields. Lemon trees made significantly better crown growth with NPK than trees given farm yard manure.

Rodriguez and Moreira (1969) observed that annual applications of 250 g N./tree during the period (1955–1966) increased yield by 32%. There were significant responses to P and K only in the last few years of the trial. N & P applications gave higher yields than separate application. Foliar levels of N, P, and K were closely related to fertilizer applications and production.

MATERIALS AND METHODS

The proposed experiment has been carried out on the Kinnow plants grown in experimental garden Square No. 9 which are budded at Rough lemon rootstock. The age of the trees was nine years at the time of first treatment in Feb. 1974. Fertilizer applications were made according to the treatments given in the schedule below :

Treatment	Dose/tree	Time of application
Control		
Urea	2-lbs N	½ dose in mid. February ½ dose after fruit setting N-application as above
Urea and Supper phosphate	2-lbs N 1-lb $P_2°_5$	$P_2°_5$ in February
Urea + diammonium phosphate (DAP)	-do-	Urea application as above while DAP in February
Urea and potassium sulphate	2-lbs N and 1-lb $K_2S°_4$	-do-
Urea and potassium sulphate + super-phos-phate.	2-lbs N 1-lb $P_2°_5$ and 1-lb, K_2So_4	-do-

The experiment was laid with completely randomized design in three replications. The experimental unit was composed of two trees and in all 36 trees were involved. The data were collected on fruit setting, drop and yield in the years 1975 and 1976.

RESULTS AND DISCUSSION

Fruit Set

The data for the fruit set for the year 1975-76 are given in Table-1. The fruit setting was not affected significantly by fertilizer treatments. However, in the second year (1976) of the trial fertilizer treatments have tended to increase fruit set as compared with the control. During 1976, the fruit set from the fertilized trees was 75 to 83% as against 68% from the control ones.

Fruit Drop

The data for total fruit drop are given in Table-1 for the year 1976. The mean differences were non-significant but it was noted that the fruit drop tended to be higher from the fertilized trees as compared with control. However, the pattern of periodical drops during the growing season showed variation with different fertilizer treatments (Table-2 and Fig. 1). During April, the month following the fruit setting period, urea in combination with potassium sulphate resulted in maximum drop of about 66 per cent while urea + super phosphate gave the lowest drop of 22 per cent. With rest of the treatments the drop in April was about equal showing a range of 38-42 per cent.

Table 1. *Effect of fertilizers on fruit set, drop and yield of kinnow mandarin (1975 and 1976).*

Particulars	Treatment Means						
	Control	Urea	Urea + Sup. Phosphate	Urea + DAP	Urea + K_2So_4	Urea + Sup. Phos. + K_2So_4	Results
Fruit Set (%) 1975	65	62	75	62	71	71	Non-sig.
–do– 1976	68	83	77	76	75	83	–do–
Total drop 1976 (% of Total fruit set)	77	90	86	91	90	79	–do–
Yield in 1975 (No. of fruits per tree)	280	245	192	239	289	359	–do–
Yield in 1976 (No. of fruits per tree)	215	305	260	229	392	397	–do–
Percentage increase or Decrease in 1976	—23	+ 25	+ 30	— 4	+ 36	— 14	

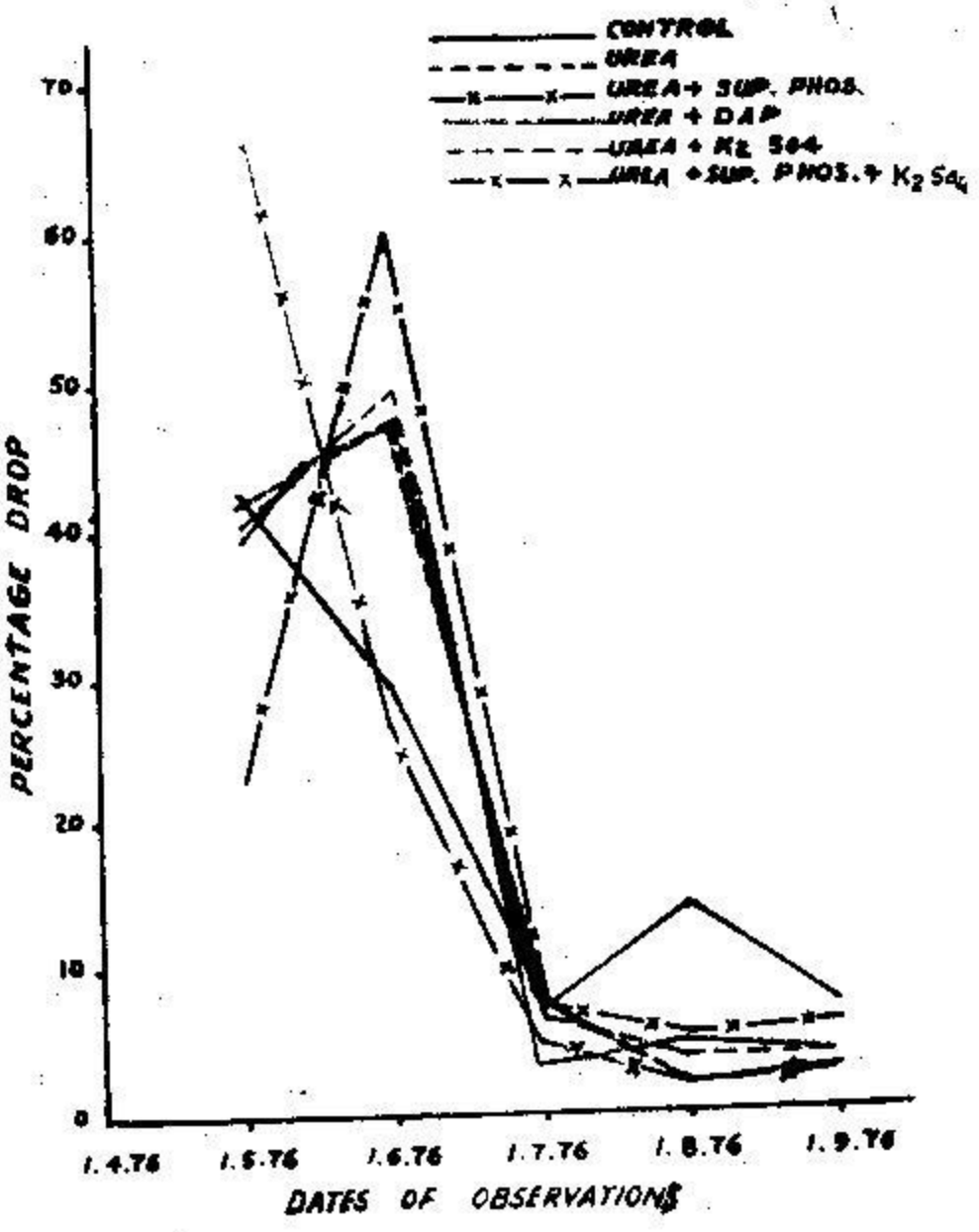
Table 2. *Effect of fertilizers on periodical drop of kinnow mandarin.* 1976. *Per cent drop at monthly intervals (Dates of observations)*

Treatment	1.5.76	1.6.76	1.7.76	1.8.76	1.9.76
Control	42.2	29.0	7.0	14.0	7.0
Urea	41.4	47.0	6.9	1.7	2.9
Urea+Sup. Phos.	22.5	60.0	6.8	4.8	5.7
Urea+DAP	38.4	51.0	2.26	4.3	3.5
Urea+K_2So_4	66.0	25.0	4.3	1.8	2.7
Urea+Sup. Phos.+K_2So_4	39.4	48.9	4.6	3.4	3.5

In May, the treatment of urea+potassium sulphate, showing maximum drop in April, had shown considerable reduction in drop which was 25 per cent. The drop from the control trees also was reduced to 29 per cent in this month against 42 per cent in April. In all other treatments there were upward trends and the maximum increase of 60 per cent was noted in treatment of urea+super phosphate. In April, the above treatment produced the minimum drop.

During June, the drop was greatly reduced in all cases and ranged between 2 to 7 per cent only. During July, slight increase in drop was noted only from control trees which again declined in August. In all fertilized trees the drop remained at low level in July and August.

FIG. 1 EFFECT OF FERTILIZERS ON PERIODICAL DROP OF KINNOW MANDARIN



Thus the data on periodical drop from the fertilized trees have shown that major drop in Kinnow is likely to occur during April and May under Faisalabad conditions. In the subsequent months the drop is reduced considerably reaching almost to insignificant level in many cases.

Yield

The data for yield during 1975-76 are given in Table-1 as mean number of fruits per tree. There was maximum yield (359) during 1975 with treatment combinations of urea, super phosphate and potassium sulphate. In other treatments there was no noticable differences. From the data recorded during 1976, it was found that in most cases the fertilized trees showed 10 to 36% improvement in yield as compared with control, whereas in unfertilized trees the yield had actually decreased by 23%. It is evident that with fertilizer application yield may be improved in subsequent years.

The present paper gives preliminary information about effects of fertilizers on fruiting. The data on fruit setting and yield have shown some changes as a result of fertilizer application but clear cut evidence will be available in the years to come.

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