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Effect of intercropping in kinnow based production system

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Abstract

Intercropping under Kinnow based production system showed a significant effect on the growth of pre-bearing trees. The available nitrogen content during pre-bearing stage in leaves of Kinnow was found lower under all the intercrops and varietal combination thereof as compared to bearing trees and it increased progressively towards bearing of the tree. The intercrops did not show any significant effect on physico-chemical parameters of Kinnow fruits, whereas, the number of fruits/plant and fruit yield/plant was maximum under moong and minimum under cotton.

Key words: *Kinnow, intercrops, moong, cotton*

Introduction

Intercropping- a practice of growing two or more crops in association is gaining popularity in widely spaced crops primarily due to claims that it augments yield on sustainable basis. Kinnow mandarin is one of the major citrus fruits under irrigated aridisols particularly in canal command areas of western Rajasthan. Many crops such as vegetable, pulses and fodder crops have been found suitable for intercropping in citrus orchards (Bajwa and Jawanda, 1954).

Suitability of intercrops depends primarily on soil and climatic conditions, however, compatibility aspect deserves prime consideration. Crops of competitive nature, may it be for light, space, nutrients or due to chemo-toxicity, are largely unpreferential and such crops are usually not grown as an intercrop. Exhaustive crops like maize, wheat, sugarcane, cotton, etc. are not worth cultivation in citrus orchard (Krishnamurthy,1959; Naik,1963). In contrast, crops with companion and synergistic attributes are considered compatible.

Cultivation of compatible intercrop is sure to accentuate early income, optimize land use efficiency, facilitate better harvest of solar radiation, reduce the soil erosion, increase biological efficiency both in time and space dimensions in fruit based production system. With such considerations, present study was undertaken at Agriculture Research Station, Sri Ganganagar for systematic investigations and various types of intercrops and their interrelations with kinnow so as to draw inferences pertaining to suitable intercrop combination.

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Materials and methods

The present study was undertaken in pre-bearing and bearing Kinnow orchards of 3-5 and 8-10 years age, respectively raised on rough lemon at the farmer's field (Lyallpur Model Farm, Sri Ganganagar). The experiment was conducted for two consecutive years from 2001-02 and 2002-03, in randomised block design with three replications. During zaid, cotton and moong whereas in rabi, barley and gram and different combination theirof were grown in both bearing and prebearing orchards. The effect of intercropping on tree growth parameters, leaf nutrient status, number of fruits, fruit yield and physico-chemical parameters were studied. The canopy volume of tree was calculated as per standard formula = $(E\text{-}W+ N\text{-}S)^2/4 \times ½$ plant height x 4.19. The leaf samples were analyzed for N, P and K status by conventional methods. No.of fruits were counted and weighed to get yield. Physico-chemical parameters of the fruit were observed. Total soluble solids were recorded using hand refractometer. Titratable acidity of juice was determined by titrating the juice against 0.1 N NaOH using phenolphthalein as an indicator and expressed in terms of citric acid (AOAC, 1970). The data recorded were subjected to statistical analysis and their significance was judged at 5% level of significance.

Results and discussion

The data presented in Table 1 clearly indicates that there was significant effect of intercrops on the growth of the trees in pre-bearing and bearing orchards during first year (2001-02) of experimentation. However, in the second year of experimentation, there was non-significant effect on the growth of tree volume under pre-bearing stage.The data pertaining to the effect of intercrops on leaf nutrient status of kinnow crop is depicted in Table 2. The results

Table 1. Effect of intercropping on kinnow tree volume

Production System	2001-02 Prebearing (m^3)	2001-02 Bearing (m^3)	2002-03 Prebearing (m^3)	2002-03 Bearing (m^3)
Cotton -Moong	2.51	46.76	5.56	47.02
Cotton -Barley	3.19	42.86	5.27	47.66
Cotton -Gram	2.57	43.27	4.11	51.18
Cotton	2.43	35.34	3.87	47.58
Moong	2.61	35.64	5.58	48.23
Gram	2.47	45.04	5.42	59.48
Barley	2.45	47.61	5.18	49.60
Control	2.64	41.26	4.16	52.08
C D at 5%	0.10	1.32	N.S.	N.S.

indicated that available nitrogen content during pre-bearing in Kinnow leaves was lower than the normal leaves under all the intercrops as compared to bearing trees. However, the nitrogen content varied from 1.48 to 2.33% in bearing tree leaves (2001-03) under different production systems.

Table 2. Effect of intercropping on leaf nutrient status of kinnow trees

Production System	2001-03 Prebearing (%) N	P	K	2001-03 Bearing (%) N	P	K
Cotton -Moong	1.73	0.10	2.77	2.08	0.11	2.67
Cotton - Barley	1.55	0.11	2.71	1.72	0.11	2.71
Cotton -Gram	1.75	0.10	2.66	2.10	0.10	2.60
Cotton	1.36	0.10	2.72	1.48	0.12	2.95
Moong	2.05	0.11	2.48	2.10	0.12	2.85
Gram	1.96	0.10	2.55	2.15	0.11	2.80
Barley	1.33	0.10	2.69	1.95	0.11	2.65
Control	2.40	0.11	2.59	2.33	0.11	2.71
C D at 5%	0.54	N.S.	N.S.	0.48	0.45	0.80

This may be due to fewer requirements and consequently less absorption of nitrogen during pre-bearing stage of the orchard. This is also true for P and K content when pre-bearing and bearing orchard leaves are compared. The available K in the leaf was non- significant in both types of leaves during 2003.

The data presented in Table 3 on the effect of intercrops on physico-chemical characters of kinnow fruit did not show any significant effect on total soluble solids content, acidity and ascorbic acid content of kinnow fruits during both the years of experimentation i.e., 2001-03.

Table 3. Effect of intercropping on physico-Chemical parameters of kinnow fruit

Production System	TSS (° Brix)		Acidity (%)		Ascorbic acid (mg/100 ml juice)	
I 2001-02 I 2002-03	I	II	I	II	I	II
Cotton -Moong	10.40	10.06	1.09	1.04	26.13	27.20
Cotton -Barley	10.50	11.20	1.07	1.06	25.06	28.26
Cotton -Gram	11.13	10.40	1.01	1.00	22.93	35.20
Cotton	10.33	10.06	1.18	1.06	22.40	29.86
Moong	9.86	10.06	1.13	1.11	22.93	34.13
Gram	10.33	10.20	1.08	1.09	25.06	34.66
Barley	10.40	11.03	1.27	1.11	20.26	28.80
Control	10.26	10.16	1.04	1.09	25.06	29.33
C D at 5%	N.S.	31.66	N.S.	N.S	N.S	4.80

Perusal of data (Table 4) clearly shows that number of fruits/plant under various treatments varied from 219 under cotton to 299 under control. The less number of fruits/ plant under cotton intercropping might be due to exhaustive nature of cotton crop resulting in nutrient competition with the kinnow crop.

The number of fruits per plant under intercrops was maximum (293) in sole cropping of pulse moong closely

Table 4. Effect of intercropping on the number of fruits and fruit yield in bearing kinnow

Production System	No. of fruits/plant 2001-03 (Pooled Mean)	Fruit yield /plant (kg) 2001-03 (Pooled Mean)
Cotton-Moong	228	45.63
Cotton-Barley	277	53.67
Cotton-Gram	280	57.47
Cotton	219	43.78
Moong	293	58.76
Gram	260	50.97
Barley	224	46.19
Control	299	59.99
C D at 5%	9.34	8.28

followed by cotton-gram (280) and cotton- barley with (277) fruits. The yield per plant varied from 43.78 kg in cotton to 57.47 kg under cotton-gram intercrops. However, the yield/plant was maximum (58.76 kg) in sole cropping of moong and minimum under sole crop of cotton (43.78 kg). This indicated beneficial relationship of leguminous crops on kinnow trees owing to complimentary interaction of green gram being leguminous in nature. Similar findings were reported by Sanchez *et al.* (1991) who reported

beneficial effect of leguminous crops on sweet orange trees. Singh *et al.* (1999) also corroborated such type of findings and reported beneficiality of pulses as intercrops in mandarin orchards owing to their ability to mobilize atmospheric nitrogen to the plant system. Under cotton based production system in either or combination mode of intercropping, less yield of fruit was recorded. It may be attributed to competitive interaction of cotton for space, water, nutrient, O_2 and CO_2 required commonly for growth and production of the plant (Reddy and Reddy, 2005).

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