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On-farm studies on agri-horticulture with citrus (*Citrus species*)

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ABSTRACT

For successful exploitation of the interspaces of citrus species, treatment combinations comprising 3 citrus species (*Citrus aurantifolia, C. sinensis* and *C. reticulata*) and 2 crop rotations (urdbean-wheat and urdbean-chickpea). *C. sinensis* registered significantly better growth (height, collar diameter and canopy) as compared to *C. aurantifolia* and *C. reticulata* under the influence of wheat crop. No significant differences in grain and straw yield of wheat were observed as influenced by the various citrus species. On an average, highest grain and straw yields of wheat were recorded from the Ist row followed by IIIrd and Vth row. Maximum production of wheat on an average was recorded during the establishment year of citrus species and production was affected in the subsequent years.

Key words : *Citrus species*, Wheat, Agri-horticulture

Citrus occupies a significant position in India as it is cultivated in every state and accounts for more than 8% of total fruit production with an area more than 9% of the total fruit area. Fruit trees normally provide enough interspaces which needs to be exploited. However, much evidence is not available regarding exploitation of the interspaces of citrus species. This necessitated the need for taking the present study.

MATERIALS AND METHODS

The experiment was conducted on farmers field at Bhattagaon (District Jhansi) during 1992-94. The treatment combination comprised 3 citrus species namely, *kagzi nimbu* (*Citrus aurantifolia*), *mausami* (*Citrus sinensis*) and kinnow (*Citrus reticulata*) and 2 crop rotations (urdbean-wheat and urdbean-chickpea) in a replicated randomized block design. Saplings of each citrus species were planted in 1 × 1 × 1 m pit size during August 1991 in a spacing of 6 × 6 m. Gross plot size was 12 × 18 m (6 plants/plot). The experimental soil was red gravelly sandy, poor in fertility, neutral in reaction, and of shallow depth having poor water retention capacity. FYM @ 5 tonnes/ha was applied before the sowing of *rabi* crops in each year. The *kharif* and *rabi* crops were raised with the recommended package of practices under irrigated conditions. Survival count and various growth parameters were recorded in the citrus species. In the present paper the

data on growth parameters and survival count in citrus species as influenced by wheat crop ('WH 147') are reported along with the grain and straw yield of wheat. In wheat the production is reported as recorded from the first, third and fifth row from the citrus trees.

RESULTS AND DISCUSSION

Growth of citrus species

Survival count in citrus species was not influenced by wheat crop sown in the interspaces. All the growth parameters were significantly influenced expect tree canopy during December 1993 (Table 1). For tree height, *mausami* was significantly superior to *nimbu* and kinnow. Similar trend was also noticed in tree collar diameter and tree canopy.

Grain and straw yield of wheat

Citrus species had no influence on grain yield of wheat as recorded from the interspaces in first, third and fifth rows (Table 2). Similar results were also achieved with on station trials conducted with 4 fruit tree species at Jhansi (Gill *et al.*, 1996). On an average (mean of 3 years), the maximum grain yield of wheat (41.71 q/ha) was recorded from the interspaces of *mausami*, followed by *nimbu* (39.75 q/ha) and the minimum in kinnow (39.21 q/ha). Among the citrus species, *mausami* performed better in respect of growth parameters and also gave the maximum wheat yield from its interspaces. This is contrary to the belief that better growth of trees have adverse effect on production of the crops raised in their interspaces. This could be attributed to greater mutual co-operation between the citrus species and the wheat crop. Usually a

Table 1. Growth data of citrus species with wheat

Citrus spp.	Fruit tree height (cm)				Tree collar diameter (cm)				Tree canopy (cm)				Tree survival (%)			
	May 1992	Dec. 1992	May 1993	Dec. 1993	May 1992	Dec. 1992	May 1993	Dec. 1993	May 1994	May 1992	Dec. 1992	May 1993	Dec. 1993	May 1994	Dec. 1992	May 1993
Nimbu	47.58	59.09	54.75	104.58	123.33	0.92	0.98	1.24	1.72	2.86	26.98	33.33	26.80	82.6	92.50	100	58.30
Mausami	80.42	125.75	132.42	193.74	214.99	1.76	3.03	3.23	4.57	6.81	45.31	78.92	78.88	160.01	193.54	100	100
Kinnow	57.70	88.58	98.00	166.91	187.04	1.16	2.30	2.35	3.71	5.28	27.18	55.21	57.71	123.01	149.27	75	87.50
CD (P = 0.05)	15.7	37.8	39.8	56.9	55.1	0.4	1.1	1.1	1.5	2.3	14.7	36.4	35.9	NS	72.5	NS	NS.

Table 2. Effect of citrus species on grain yield of wheat

Citrus species	Grain yield of wheat (q/ha)											
	1991-92				1992-93				1993-94			
	I row	III row	V row	Mean	I row	III row	V row	Mean	I row	III row	V row	Mean
Nimbu	50.44	46.84	48.97	48.75	38.90	41.70	37.90	39.50	33.59	30.81	28.59	30.99
Mausami	54.07	50.94	51.43	52.15	40.20	38.20	41.90	40.10	34.70	30.40	33.59	32.89
Kinnow	51.01	48.09	48.65	49.25	41.90	38.40	37.47	39.25	32.48	28.04	26.92	29.14
Mean	51.84	48.62	49.68	50.05	40.33	39.43	39.09	39.61	33.59	29.75	29.70	31.01
CD (P = 0.05)	NS	NS	NS		NS	NS	NS		NS	NS	NS	

Table 3. Effect of citrus species on straw yield of wheat

Citrus species	Straw yield of wheat (q/ha)											
	1991-92				1992-93				1993-94			
	I row	III row	V row	Mean	I row	III row	V row	Mean	I row	III row	V row	Mean
Nimbu	54.07	48.79	50.94	51.26	47.07	49.90	42.20	46.39	46.08	34.14	36.08	38.76
Mausami	60.74	55.94	55.46	57.38	46.95	42.70	42.30	43.98	43.03	34.00	47.47	41.50
Kinnow	58.24	54.76	51.07	54.69	45.60	47.90	50.30	47.93	49.13	33.03	35.81	39.32
CD (P = 0.05)	NS	NS	NS		NS	NS	NS		NS	NS	NS	

yield advantage occurs because the component crops differ in their use of growth resources in such a way that when they are grown in association they are able to complement each other and so make better overall us of resource than grown separately (Willey, 1979).

On an average (mean over 3 years), the maximum grain yield of wheat was recorded from the first row (41.92 q/ha), followed by third row (30.33 q/ha) and fifth row (26.69 q/ha). The production of wheat was the highest in the year of the establishment of citrus species irrespective of rows (50.04 q/ha) and in the subsequent years it was reduced to 39.61 q/ha and 31.01 q/ha during 1992-93 and 1993-94 respectively. With the increase in fruit tree growth parameters (plant height, collar diameter and tree canopy), there was a direct impact on the yield of wheat irrespective of the citrus species. Similar trend was also noticed in the no-station trial (Gill *et al.,* 1998). In the present study the fruit trees were the dominant component and the wheat as the dominated component. The trend in straw yield of wheat as influenced by the citrus species was similar as reported for grain yield of wheat (Table 3).

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