



Intercropping with vegetables on productivity and economic returns of Kinnow in arid region

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ABSTRACT

Experiments were carried out to study the productivity and economic performance of intercropping of Kinnow with vegetable crops. There were five treatment combinations viz., (i) Kinnow + (Onion (*Allium cepa*)-Indian squash (*Citrullus lanatus* var. *fistulosus*), (ii) Kinnow + (Radish (*Raphanus sativus*- Cowpea (*Vigna unguiculata*), (iii) Sole Onion- Indian squash, (iv) Sole Radish- Cowpea and (v) Sole Kinnow. Intercropping showed positive effect on height, girth and canopy spread of Kinnow over its sole plantation. The fruit yield of Kinnow was significantly improved by intercrops as compared to sole Kinnow. However, the productivity of both *rabi* and *kharif* season crops was less with Kinnow as compared to sole cropping. The onion in *rabi* season and Indian squash in *kharif* season were better options for intercropping system in terms of crop yield equivalents as compared to sole Kinnow. The annual system productivity in terms of onion equivalent yield (OEY) was 2.81 and 7.58 times higher in Kinnow + (radish-cowpea) and Kinnow + (onion-Indian squash) as compared to sole Kinnow, respectively. Water productivity in terms of economic yield (WP_{EY}) was improved to 4.23 and 1.86 kg/m³ in intercropping system of Kinnow + (onion –Indian squash) and Kinnow + (radish-cowpea) as compared to sole Kinnow (0.62 kg/m³). Similarly, the water productivity in terms of gross return (WP_{GR}) was improved to 22.73 and 9.51 Rs/m³ in Kinnow + (onion – Indian squash) and Kinnow + (radish-cowpea), respectively as compared to 4.98 Rs/m³ in sole Kinnow. The B: C ratio of Kinnow + (onion-Indian squash) and Kinnow + (radish-cowpea) was improved to 3.65 and 2.06, respectively, as compared to sole Kinnow (B: C ratio of 1.50).

Key words: Intercropping, kinnow, water productivity, vegetables, arid zone

INTRODUCTION

Thar desert of Rajasthan occupies major part of north-western India (28.7 m ha). The region is characterised by extremes of climatic conditions with low rainfall and high temperature. The soils of the region are poor in organic matter, low in clay and silt, and poor in nutrient availability (Kumar *et al.*, 8). Yield losses associated with water stress and soil erosion are common in this zone (Soni *et al.* 14; Soni *et al.*, 15; Santra *et al.*, 12). With the inception of irrigation facility through Indira Gandhi Nahar Pariyojana (IGNP), growing of suitable group of citrus fruits such as Kinnow, acid lime and sweet orange are now becoming popular and their area is increasing day by day.

Kinnow a mandarin hybrid, is gaining popularity among the fruit growers of Khajuwala, Chhattargarh and Charanwala area of Bikaner district having irrigation facility. The crop has a great potential for its expansion due to consumers preference, high yield and better economic returns. Kinnow growers also grow few vegetable crops as sole crop which however, can also be grown as intercrop with Kinnow mandarin. Growing suitable vegetables as intercropping with fruit trees will

make the system more economic to the farmers in terms of generating extra income, enhancing productivity per unit area and time, and improve ecological situation. Though intercropping of trees with suitable vegetables seems remunerative, yet meager scientific information is available regarding production, water productivity and economics of Kinnow based oleri-horti system in western part of Rajasthan. Previous studies conducted in other parts of India revealed that the economy of Indian farmers can be improved through intercropping systems in sweet orange (Ghosh and Pal, 16) and Kinnow (Bhatnagar *et al.*, 3). There is hardly any systematic research work on growing fruit trees with vegetable crops in arid regions of Rajasthan. Hence, the present experiment was conducted to assess the yield, water productivity and economic performance of Kinnow based oleri-horticultural systems in hyper arid partially irrigated zone of western Rajasthan.

MATERIALS AND METHODS

The study was carried out at farmer's field located at RD-7J of Charanwala branch of IGNP stage-II (72°10'23.81"E longitude and 27°54'28.36" N latitude) during *rabi* and *kharif* seasons of 2015-16 and 2016-17, respectively in Bikaner district of Rajasthan. The region falls in Agro-climatic zone I-C (Hyper arid partial irrigated zone) and is characterised by arid climatic

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