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Effect of Intercropping Systems on Fruit Yield and Quality of Kinnow Mandarin in Aridisol

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Abstract: Effect of different field crops on tree performance fruit yield and quality in different Kinnow orchards in aridisol was observed. The tree height, canopy volume ofKinnow shown maximum increase in Kinnow mandarin + soybean followed by desi gram intercropping pattern. The highest Kinnow yield of 41.6 kg/ tree was recorded in the intercropping of Kinnow mandarin + soybean followed by *desi* gram. Fruit quality parameters were superior in Kinnow mandarin + soybean followed by desi gram treatment. The fruit acidity and juice percent were significantly affected by different intercropping patterns. High soil moisture was observed in intercrops of soybean, groundnut and summer moong. Intercropping system of groundnut + soybean or arhar + desi gram in the interspaces of Kinnow mandarin improved the yield as well as sustainability of mandarin.

Key Words: Aridisol, Kinnow, Leguminous, Plant growth, Yield, Intercropping systems

Kinnow orchards grown in aridisol had loamy sand to sandy in soil texture. Soil texture has considerable influence on nutrients and water retention. Sandy soils have poor water holding capacity, high infiltration rate and low nutrient retention capacity. The use of different intercrops provides an effective strategy to obtain additional income during off-season without inducing any stress on soil moisture and soil fertility. The main objective of this investigation is to search for suitable intercropping system near the mandarin root zone area to improve the soil moisture and soil fertility status in long term with emphasis on the health and yield performance of Kinnow trees.

MATERIAL AND METHODS

An extensive survey of 27 bearing Kinnow orchards was carried out with seven intercrops during 2011-2013 in aridisol of Punjab state. The various intercropping treatments were in randomized block design with three replications and six plants per unit. The soil moisture constants for field capacity and permanent wilting point were analysed using pressure plate apparatus (Soil moisture Inc., Santa Barbara, USA). Kinnow mandarin plants were spaced at 6 m with an average canopy area of 23.10- 30.31 m^3. In Kinnow mandarin orchards peas (Punjab 89) sown in 3 m space in between two rows of mandarin spaced at 6 m. In *kharif* season arhar (PAU 881), moong (PAU 911), groundnut (*SG 99*) and soybean (SL 525) whereas, in *rabi* season desi gram (GPF2) and in summer moong (SML 832) and peas (Punjab 89) were sown as intercropped. After sufficient monsoon land attained field capacity the intercrops of *kharif* season were sown. The soil moisture at field capacity was 31.2%, available soil depth 120 cm inKinnow mandarin orchards. From June to September sufficient soil moisture in the main as well as intercrops was maintained due to effective rainfall. Surface flooding was done in intercrops and basin method of irrigation was followed adopting the calendar method of irrigation scheduling. Irrigation was followed when 50% of available water content was depleted. The soil moisture monitoring at 30 cm depth was done at 15 days interval with the help of soil moisture monitoring soil profile probe and soil moisture monitoring meter. The FRP tubes were installed in each treatment for monitoring the soil moisture with profile probe. The experiment was initiated and initial growth parameters were recorded during October. Increase in vegetative growth parameters, i.e. plant height and canopy volume were recorded from 2011to 2013 as per recommended method. Soils were analysed for their physico-chemical properties such as soil texture, soil pH (1:2) (using HNO_3 and $HClO_4$ mixture for digestion) were prepared and analysed for Cu, Fe, Mn and Zn using Atomic Absorption Spectrophotometer "Perkin Elmer" model No.2380 while K using 'Perkin Elmer' Flame Photometer model No.2380 and P by Spectrophotometer "SpectronicbLmbda (λ) 35" using required standard solutions. Available nitrogen in soils and plants were determined using Kjeldahl distillation. The total fruits harvested from each tree were weighed for computing the yield and quality analysis.

RESULTS AND DISCUSSION

Among different intercropping systems soil moisture was lower in no intercrop Kinnow orchards. This may be due to lower row spacing and larger foliage coverage and comparatively higher soil moisture was observed in soybean, desi gram and groundnut intercrops. Moderately