INDIAN JOURNAL OF ARID HORTICULTURE
2013 Vol. 8 (1-2): 82-85

SHORT COMMUNICATION

Impact of intercropping in disease management in mandarin

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(Received : 18.12.2013, Accepted : 25.1.2014)

Nagpur mandarin (*Citrus reticulata* Blanco) is the most valued member of Rutaceae family and enjoy predominant position among fruit crops grown in the country. Brazil, USA, Mexico, India, China, Spain, Italy, Iran, Egypt and Pakistan are the major producing countries of mandarin in the world. Nagpur, Akola, Amrawati and Wardha in Maharashtra; Jhalawar and Kota in Rajasthan; Chikmagalur, Kodagu and Hassan in Karnataka; Chhindwara, Mandsaur, Betul, Ujjain and Shajapur in Madhya Pradesh; Wokha and Tuensang in Nagaland; Darjeeling in West Bengal; Tinsukia , NC Hills, Karbi and Anglong in Assam; East and West Khasis, Ribhoi, Garo Hills and Jaintia Hills in Meghalaya and Tripura are the major mandarin belts in the country.

Mandarin fruits are mostly consumed as fresh. It is processed into various products and by-products. The essential oil possesses anti-fungal property against phytopathogens. Hesperidins, the most abundant bioflavonoid in juice of oranges has been found to inhibit metabolization of precarcinogens into carcinogens reducing the chance of cancer in human being.

Multifold nutritional and medicinal values of fruits have made them especially important in the nutritionally aware consumer world. The fruits of mandarin command demand in the market. There is need to augment production and productivity of the crop. However, the productivity of the mandarin orchard in India is 7-8 tonnes/ha only as against 25-30 tonnes/ha in major citrus growing countries of the world (Sharma, 2006). In Jhalawar district 8492.26 hectare area is under mandarin production and the total production as per the statistics for the year 2009-10 is 160509.79 tonnes (Anon., 2009-10). It has been established that disease alone account for 20 % loss in yield in agriculture in general (Panda,2005). Managing them properly has its worth in hastening production and productivity. With such a view, a survey of different area of the Jhalawar district was conducted and attempt has been made to draw impact of intercropping on the incidence of diseases in mandarin.

The district falls under sub humid South Eastern plain under Zone V. Jhalawar extends over 6.32 lac hectare area among $23^0$40 to $24^0$52 N- latitude and $75^0$29 to $76^0$56 E-longitudes in south Eastern Rajasthan. Average rainfall in the region is 1000 mm. Maximum temperature range in summer is 43^0 to 47^0C and thus the minimum temperature during winter is 4^0 to 6^0C.

The long-term mean annual rainfall of the district is 910 mm with a standard deviation of 218 mm and a coefficient of variation of 24 %. On long term basis the district experiences 38 mean number of rainy days with a standard deviation of 6 days and a coefficient of variation of 15.49 %. The annual mean, maximum and minimum monthly relative humidity of the region are 69 %, 91 % (August) and 31 % (July) respectively. Temperature varies according to altitude. The annual mean, maximum and minimum monthly mean daily temperatures in the district are 27.48°C, 48.8°C (May) and 5.5°C (February), respectively.

However, during study period (October, 2008 till May, 2009), the maximum temperature varied form 44.58^0C during May to 24.5^0C during January and the minimum from 9.9^0C December to 27.5^0C during May. The relative humidity was observed 95 % during December and the minimum 7 % during April. Rainfall of 35.5 mm magnitude was observed during November and those of 10 mm was observed during May in three span (Fig. 2).

In an attempt to study the influence of intercropping on the incidence of diseases in mandarin orchard, a survey of orchards located in Asnawar, Jhalarapatan, Junakhera, Aktasa, Manpura, Kherla, Guradia, Salotia, Pirawa and Pachpahar localities of the Jhalawar district were made during 2008-09. The detailed information of intercrops grown in the orchard during different season of the year in the aforesaid locality and incidence of diseases was collected on the basis of personal interview of the landlord and are presented here under Table 1.

Going through the information furnished under Table-1, it appears that out of phytophthora rot, sooty mould, vein yellowing and soft rot, the first two diseases were more pervasive in the area. In the orchards wheat, mustard, barley, lucern, soyabean, cauliflower, cowpea, clusterbean, coriander, etc were found as the major intercrops in the locality. Further, the orchard where garlic was intercropped the incidence of the diseases was minimum. It may be due to presence of sulphur containing aroma compounds; allyl-

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propyl-disulphide in garlic plants. The aroma emancipated in the nearby environment from the plant might serve as a sheath in safeguarding mandarin from the attack of diseases. It was also noted that garlic was an intercrop in the orchard which was having proper penetration of solar radiation on the ground surface. It becomes possible during early stage of orchard. In general, early stage plants are strong and vigorous enough to ward themselves from the incidence of diseases by virtue of presence of range of metabolites inside plant system.

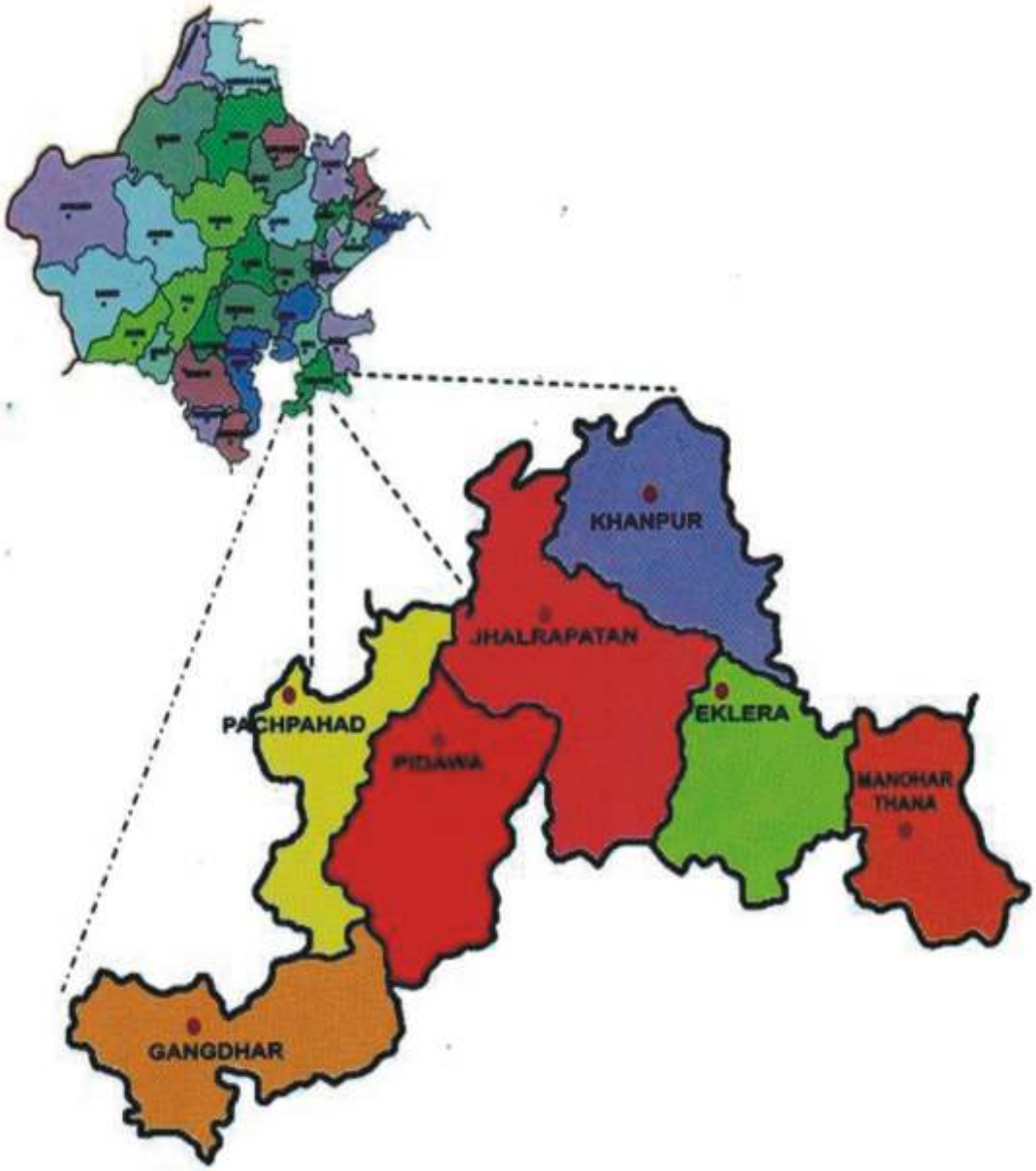

Fig. 1 Map of Jhalawar district, Rajasthan

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Table 1. Commonly grown intercrops and incidence of diseases in mandarin orchard

S. No.	Name of orchardist	Locality	No. of tree in orchard	Intercropping followed	Incidence of disease
1.	AS-01	Asnawar	680	Lucern, Barley	Phytophthora rot, Sooty mould
2.	JH-02	Jhalarapatan	750	Coriander, Soybean	Sooty mould
3.	JK-03	Junakhera	397	Wheat, Soybean	Phytophthora rot
4.	JK-04	Junakhera	400	Garlic	Nil
5.	AK-05	Aktasa	720	Fenugreek, Soybean	Phytophthora rot, vein yellowing
6.	AK-06	Aktasa	200	Garlic, marigold, clusterbean	Nil
7.	AK-07	Aktasa	400	Garlic, cauliflower, brinjal, spinach	Nil
8.	DT-08	Dityakher	300	Garlic, soyabean, mustard	Nil
9.	MP-09	Manpura	330	Fenugreek, Gram	Phytophthora rot
10.	KH-10	Kherla	600	Coriander, Soyabean	Sooty mould
11.	GR-11	Guradiya	450	Mustard, Wheat, Moong, Cowpea	Phytophthora rot
12.	SA-11	Salotia	493	Coriander, Maize	Phytophthora rot
13.	PR-12	Pirawa	200	Wheat, Urd	Phytophthora rot
14.	PR-13	Pirawa	330	Wheat, Soyabean	Sooty mould
15.	PR-14	Pirawa	250	Fenugreek, Urd	Phytophthora rot
16.	PR-15	Pirawa	170	Wheat, Soyabean	Phytophthora rot, vein yellowing
17.	PC-16	Pachhpahar	400	Coriander, Soyabean	Phytophthora rot
18.	PC-17	Pachhpahar	600	Mustard, Soyabean	Sooty mould
19.	PC-18	Pachhpahar	300	Wheat, Soyabean	Phytophthora rot
20.	PC-19	Pachhpahar	80	Soyabean	Sooty mould, Soft rot
21.	PC-20	Pachhpahar	330	Nil	Sooty mould
22.	PC-21	Pachhpahar	300	Nil	Sooty mould

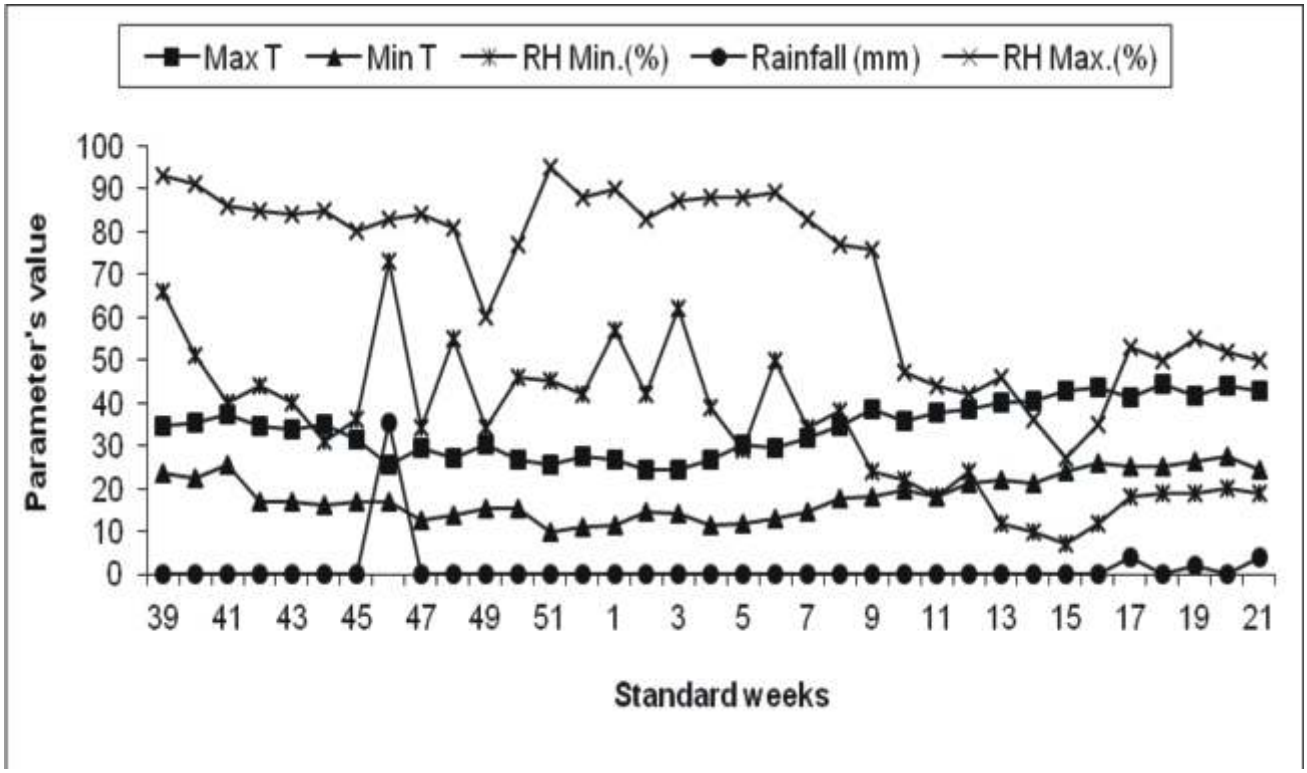

Fig.2. Climatic parameters during study period of Oct, 2008 to May, 2009.

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