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EFFECT OF PLANTING DATES ON THRIPS POPULATION AND TRANSMISSION OF GROUNDNUT BUD NECROSIS VIRUS IN EARLY POTATO

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The potato (*Solanum tuberosum* L.) is grown in many parts of North-central and North-western parts of India under wide range of agro climatic conditions as an early cash crop fetching 70-80% higher remunerative price in the market (Bhatnagar *et al*, 2011). However, the production of this crop is hampered by various biotic and abiotic factors. The most important among them is thrips, *Thrips palmi* Kerny (Bhatnagar, 2007a) and transmitting important groundnut bud necrosis virus (GBNV), resulting in stem necrosis disease in early potato. This disease has assumed significant status especially in parts of Madhya Pradesh, Rajesthan and Gujrat a decade earlier (Khurana *et al,* 2001). Thrips a cosmopolitan and important insect which attack weeds, flower, trees and large number of field and vegetable crops (Ananthakrishan, 1980; Kawari, 1986). Thrips can cause 20-60% damage to early potato crop depending upon climatic conditions. With the increasing temperature due to global climate change, the incidence of thrips is expected to increase in central India (Bhatnagar *et al*, 2014). The yield loss by thrips is mainly due to transmission of stem necrosis disease (Bhatnagar, 2007b, Bhatnagar and Thakur, 2008, Ullman *et al*, 1997). Temperature and humidity plays an important role for multiplication of vector population and subsequent development of disease in early potato due to transmission of GBNV (Bhatnagar, 2011, Bhatnagar *et al*, 2011). The repeated use of insecticides is increase the cost of cultivation and also increase environmental pollution hazard on non-target organisms. The problem is further aggravated due to the development of resistance against conventional insecticides being used by the farmers (Bhatnagar, 2013). Therefore, in view of this problem, efforts were made to evaluate early planting dates of potato with relation to weather factors, thrips population and incidence of stem necrosis disease.

The field trial was laid out for three consecutive years i.e. *2011, 2012* and *2013* in randomized block design with four replications at Central Potato Research Station, Gwalior. The most susceptible potato cultivar Kufri Chandramukhi was planted on different dates of planting (15th September, 20th September, 25th September, 30th September, 5th October, and 10th October)

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following standard agronomic practices to raise the good crop in the respective years. The population of thrips was recorded from the top portion of potato plants by shaking plant on white paper fixed on cardboard (20 cm × 20 cm) at weekly interval on 10 randomly selected plants. The population of thrips was separated with the help of zero number brush and preserved in a mixture of 10 parts of 60% ethyl alcohol + one part of glycerine + one part of acetic acid. The incidence of thrips was recorded in succession after five weeks of crop growth till the physiological maturity of the crop while incidence of stem necrosis disease in 60 days old crop of different planting dates. The yield was recorded from net plot after removing haulm of 80 days old crop in the respective years. The various weather factors like temperature, humidity, sunshine hours and evaporation along with rainfall were recorded from metrology unit in the respective years. The data were subjected to statistical analysis separately for each year and pooled for three years. The correlation and regression analysis was also carried out using three years mean of weather factors, thrips population along with incidence of disease.

The results from the three years mean data on thrips population showed that planting in the month of September recorded significantly higher thrips population than crop planted in October month (**Figure 1, 2 and 3**). However, period between different 15th September to 30th September did not differ significantly as regards the mean population of thrips (19.64-22.84/10 plants), when recorded 40 days after planting in respective planting date treatment. The pooled data revealed that highest thrips population (22.84/10 plant) was recorded in 15th September planted crop with 23.40% incidence of stem necrosis disease as compared to October planted crop **(Table 1).** The high temperature (30-35°C) and dry weather during September is favorable for the development of stem necrosis disease (Khurana *et al.*, 2001). There was low incidence of stem necrosis disease and thrips on crop during 2012 and 2013 as compared to 2011, due to no rains before planting during September month (**Figure 1, 2, 3 and 4**). Mean tuber yield data revealed that early planted crop (15th September) was recorded low total tuber yield (10.79 t/ha) when planted on 15th September as compared to 10th October planted crop (19.80 t/ha). The mean data of three years of thrips population,

Table 1. Population of thrips, stem necrosis incidence, tuber yields and weather parameters in potato crop of different planting dates (mean data, 2010, 2011 and 2012)

Treatments Planting date	Thrips population/ 10 plants	% stem necrosis disease incidence	Total tuber Yield (t/ha)	Max. Temperature (°C)	Min. Temperature (°C)	Relative humidity (%) Mor.	Relative humidity (%) Even.	SSH (hrs)	Evaporation (mm)
15th September	22.84	23.40	10.79	34.80	16.23	72.40	49.83	6.64	4.48
20th September	20.98	19.80	11.86	33.37	15.90	67.80	49.03	8.25	4.21
25th September	19.13	17.37	14.14	32.67	15.43	68.20	44.83	7.07	3.94
30th September	19.64	14.70	14.98	30.97	14.60	75.07	51.27	5.52	3.45
5th October	16.05	11.93	17.08	29.83	10.83	67.70	44.40	7.27	3.70
10th October	13.88	8.37	19.80	28.17	9.10	75.27	44.50	6.16	3.08
SEm±	3.09	4.80	2.84	-	-	-	-	-	-
CD (p=0.05)	0.96	1.50	0.89	-	-	-	-	-	-

*No rains during crop seasons **Thrips population and weather factors of each treatment 40th days after planting

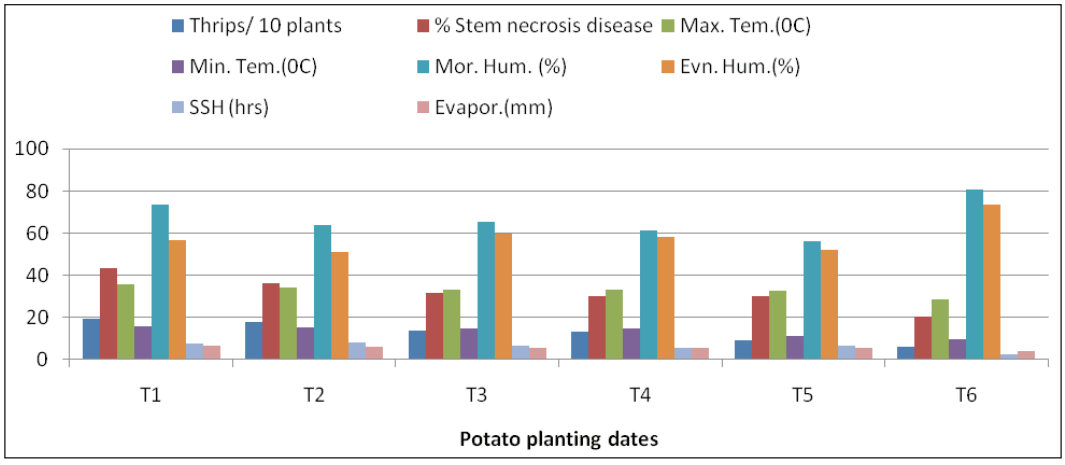

Fig. 1. Population of thrips, % stem necrosis disease on early potato crop along with weather parameters (mean of 2011)

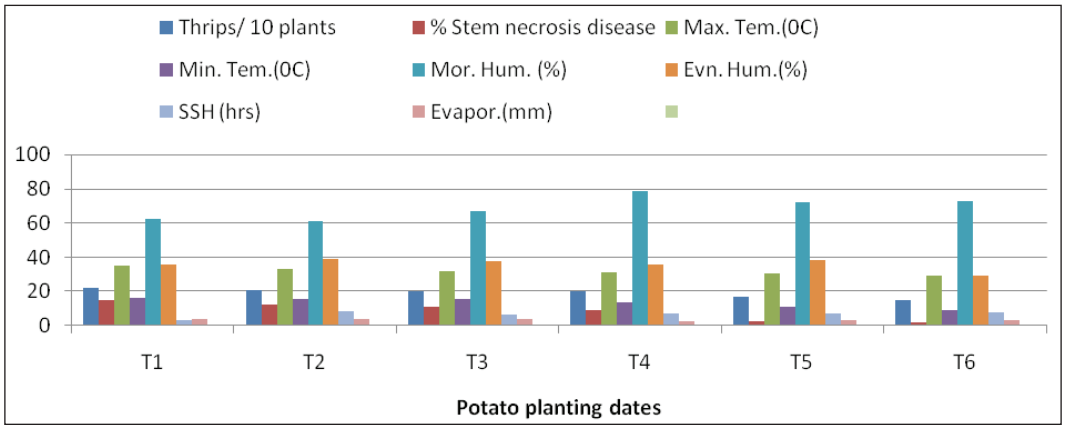

Fig. 2. Population of thrips, % stem necrosis disease on early potato crop along with weather parameters (mean of 2012)

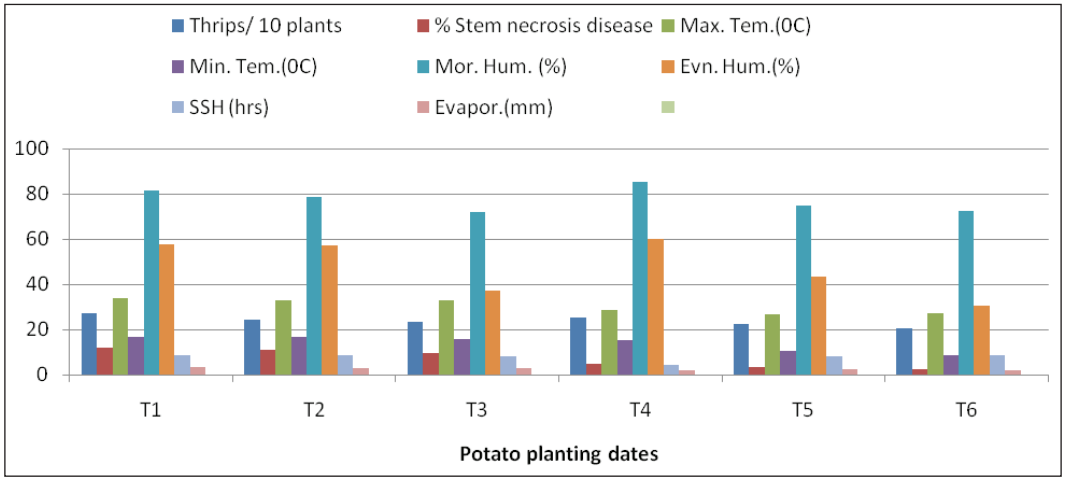

Fig. 3. Population of thrips, % stem necrosis disease on early potato crop along with weather parameters (mean of 2013)

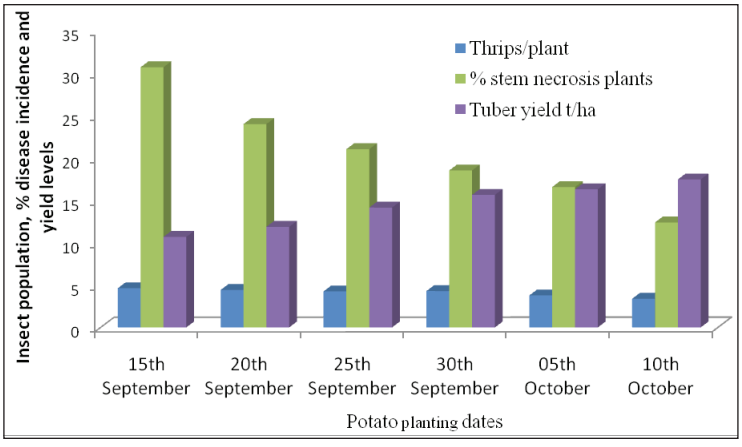

Fig. 4. Population of tuber planting dates on thrips, disease and potato yield (years mean data)

stem necrosis disease incidence and tuber yield showed significant difference among the different dates of planting (**Figure 4**). Bhatnagar *et al*, 2011 also reported that early potato crop sown between mid September and early October was heavily damaged (15-30% plants) by the potato stem necrosis disease which resulted in 10-15% loss in tuber yield.

The correlation between the thrips population with stem necrosis disease incidence, weather factors and tuber yield are presented in Table 1 and 2. It is evident from Table 2 that a high degree of positive and significant correlation exists between the thrips population and disease incidence (1.60) indicating that increased the population of thrips with increase the incidence of disease. Further, the correlation co-efficient between the population of thrips with maximum temperature (1.28), minimum temperature (1.05) and evaporation (5.54) revealed a higher positive and significant correlation. The non significant correlations (0.80 and 0.79) were exhibited by the evening humidity and sunshine hours, respectively. Further, the correlation between tuber yield and thrips population showed significant negative (-10.53) indicating tuber yield was influenced by thrips population directly and incidence of disease indirectly. The population of thrips did not showed correlation with morning humidity.

Table 2. Regression and correlation coefficients of different variables

Variables	'R²'	Correlation co-efficient 'b'
Y Thrips population	-	-
X_1 Disease incidence	0.940	1.60**
X_2 Tuber yield	0.966	-10.53**
X_3 Max. Temperature	0.920	1.28**
X_4 Min. Temperature	0.921	1.05**
X_5 Mor. humidity	0.03	-0.162, NS
X_6 Eve. humidity	0.57	0.80, NS
X_7 SSH	0.04	0.76, NS
X_8 Evaporation	0.74	5.54*

The high incidence of stem necrosis disease in month of September planted crop was attributed to higher temperature and lower humidity prevalent on crop which was also favorable for the vector, thrips to develop and multiply. Higher temperatures (35 ± 1°C) are highly suitable for both thrips and tospo virus development (Bhatnagar, 2011). Further, Bhatnagar and Thakur (2008) reported that favorable period for the activity of *T. palmi* on early planted potato crop was between the crop emergence to fifth week of crop growth and consequently transmitting tospo

virus. The present findings are in agreement to the earlier findings of Bhatnagar, 2007b and Bhatnagar and Thakur, 2008. Therefore, potato crop grown for table purpose will required better management tact tics i.e. one or two more sprays of insecticides will be added in the management schedule against thrips especially September planted crop in Central region.

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