Regression Equation Model for Brinjal Pests (*Solanum melongena* L.) in Maharashtra Plain zone

ABSTRACT

An experiment "Effect of weather parameters on growth, yield and insect pest infestation on brinjal varieties under different planting windows" was carried out at Faculty of Agriculture Department of Agricultural Meteorology Farm, Centre for Advanced Agricultural Meteorology, College of Agriculture, Pune during Kharif seasons of 2014 and 2015.The experiment was laid out in split plot design with three replications.The treatment comprised of three brinjal hybrids viz.,V1:Phule Arjun, V2: Krishna, V3: Panchganaga as main plot and four planting windows viz., P1: 31st MW (30 July-5 August), P2: 32ndMW (6-12August), P3:33rdMW (13-19 August) and P4: 34thMW (20-26 August) as sub plot treatments.

The correlation of meteorological parameters with incidence of brinjal shoot and fruit borer was studied in 2014. The correlation of shoot and fruit borer on brinjal (0.764*and 0.796*) and (0.784* and 0.704*) with the weather parameters are presented. Whereas morning relative humidity, rainfall and bright sunshine hours showed positive correlation with shoot and fruit borer population Average number of aphids/ jassid/ whiteflies plant showed highly significant negative correlation with minimum temperature(r= -0.702*,-0.710* and 0-.800*,) respectively. During 31stMW planting windows maximum temperature showed significant negative correlation with shoot and fruit borer population(r= -0.796*).It was observed that the infestation of shoot and fruit borer started increasing from October to November and its decreased onwards meteorological week.

Amongst all the brinjal hybrids, Phule Arjun hybrids found significantly superior under extended planting windows followed by Krishna and Panchganga. Planting during 31st MW (1st week of August) was observed to be most suitable and optimum for brinjal considering the growth and yield attributes. This planting window was at par with 32nd MW planting window. Linear correlation analysis for brinjal fruit yield with weather parameters was significantly positively correlated with maximum temperature and minimum temperature.

Timely planting during 31st MW (P_1) and 32nd (P_2) recorded lower incidence of shoot and fruit borer, aphids, jassid and whiteflies.Whereas,crop planted during 34thMW (P_4) recorded maximum incidence of all pests. Among the brinjal hybrids, higher incidence was recorded with Panchganaga and minimum was recorded on Phule Arjun.

Among the brinjal hybrids lower incidence of shoot and fruit borer, aphids, jassids and whiteflies was recorded on hy.Phule Arjun,which was found to be tolerant.This was followed by hy.Krishna. The higher incidence of all pests was recorded hy.panchganga,which was found to be susceptible. Pest population on brinjal shoot/fruit/Aphid/Jassid/Whiteflies had significant negative correlation with minimum temperatures, whereas, morning and evening relative humidity, wind speed, pan evaporation and bright sunshine hours showed positive correlation pests population.

Introduction

Vegetables plays very important role in Indian economy. They are valuable part of human diet as well as nutrition among vegetable crops. Brinjal (*Solanum melongena* L.) is most important protein and vitamin producing crop and occupies an important place in international trade. It is cultivated on large scale in many parts of the world particularly, USA, USSR, China and Japan.

Brinjal also referred to as egg plants or aubergines. The plant flourishes in hot climates but can not tolerate drought. Brinjal is sensitive to cold weather and are damaged easily by frost. Brinjal are low in calories, contain mostly water with some protein, fiber and carbohydrates and no fats. It is an important solanaceae crop of sub-tropics and tropics.The name Brinjal is popular in Indian subcontinents and is derived from Arabic and Sanskrit.

It is subjected to attack by number of insect pest right from nursery stage till picking. Among the insect pests infesting brinjal, the major ones are shoot and fruit borer, *Leucinodes orbonalis* (*Guen*.), whitefly, *Bemicia tabaci (Genn.)*, leafhopper,Jassid, *Amrasca biguttula biguttula (Ishida),* Aphid, *Myzus persicae*, Epilachna beetle, *Henosepilachna vigintiocto punctata (Fab.)* and non-insect pest, red spider mite, *Tetranychus macfurlanei.* The brinjal shoot and fruit borer, *L. orbonalis* is considered the main constraint causing economic damage as it damages the crop throughout the year (Nayar *et al.,* 1979)

This pest is reported from all brinjal growing areas of the world including Germany, Burma, USA, Srilanka and India. It is known to damage shoot and fruit of brinjal in all the stages of its growth. The yield loss due to the pest is to the extent of 70-92 per cent.

Shoot and fruit borer causes serious damage to the crop leading to severe reduction in yield.Short pinkish larvae of the pest initially bores into the terminal shoots resulting in withering and drying up of the shoot. In the later stage, it bores into the young fruits by making holes and feeding from within thereby making the fruits unfit for consumption. Attacked fruits rot in severe case. The indiscriminate use of different chemical pesicides for the control insect pest on brinjal leads the resistance and resurgence among the pest and residues in the environment.

Climatic factors are effective on the survival, development and reproductive capacity of insect pests. Their activities are mostly dependent on the environmental temperature for maintenance of life cycle. Prolonged periods of low or high temperatures or sudden change in them adversely affect the insect development. Different levels of humidity and rainfall, likewise, increase or reduce the population of certain insect pest species (Prasad and Logiswan, 1997).These factors affect the life cycle, propagation, and outbreaks of insects to such an extent that they are either compelled to adapt themselves to the changing climatic conditions or perish Brinjal is one of the most common vegetables in India and is extensively cultivated in *Kharif* and *Rabi* season. Timings of the management activities are crucial for the implementation of pest management tactics and cunsuming higher doses of pesticides.

MATRIALS AND METHODS

The field experiment was conducted at Department of Agricultural Meteorology Farm, College of Agriculture, Pune during kharif seasons of 2014 and 2015. The experiment was conducted in a split plot design with three replications. The treatments were allotted randomly to each replication by keeping the gross plot size 4.5m x 3.75 m2 and net plot size 2.7 m x 2.7 m2with 90 x 75 cm spacing. There were twelve treatment combinations. The experiment was laid out in split plot design with three replications. The treatment comprised of three brinjal hybrids viz., V1: Phule Arjun V2: Krishna, V3:Panchganga as main plot and four planting windows viz., P1: 31MW (30 July- 3Aug), P2:32nd

MW (6 Aug- 12 Aug),P3: 33rd MW (13Aug- 19 Aug) P4: 34th MW (20 Aug- 26 Aug) as sub plot treatments.

Population dynamics of insect pests

Weekly insects counts were recorded from 10 randomly selected plants in each plot. Field observations on insect pest population was recorded during the cool hours of the day (7.00 to 9.30 am and 4.00 to 6.00 pm). The data on fruit damage was calculated from 10 fruit sample randomly from each treatment. From this mean fruit damage was calculated.

Shoot and fruit borer

Picking of fruits was done at weekly interval. Fruit infestation was recorded after each picking by counting total number of harvested and damaged fruits. Healthy and damaged fruit yield were recorded from each plot separately. Observation on okra fruit and shoot borer infestation was arcsine transformed before statistical analysis. Fruit infestation and yield (q per ha) was worked out with the help of following formula.

$$\text{Per cent fruit infestation} = \frac{\text{Number of damaged fruits x 100}}{\text{Total number of fruit (Healthy + Damage)}}$$

Sucking pests viz., Aphids, Jassids and Whiteflies

For the population dynamics of sucking pests viz., aphids, jassids and whitefly, the observations were recorded on three leaves (top, middle and bottom) of ten randomly selected plants at each spot in the untreated block during each meteorological week (MW) along with the weather parameters. Correlation of weather parameters with the population dynamics of sucking pests was worked out.

Results and Discussion

Regression Equation Model for Brinjal Pests

Forewarning the peak abundance of insect pests and diseases in advance helps in timely management of crop pests. The correlation and multiple regression analysis clearly showed the importance of weather parameters in predicting the pest and disease incidence. Among the regression models used for forewarning the pest and disease incidence, linear regression equation models appear to predict the pest and disease incidence more accurately than the other regression equation model. Among studied weather parameters in *kharif* season 2014 and 2015 on shoot and fruit damage, aphids, jassid and whiteflies the multiple regression analysis by step down method was worked out with weather parameters.

The overall step down multiple regression analysis between shoot damage on weight basis with weather parameters of planting windows.

Shoot damage = – 314.78 + 1.50 RH-I – 0.415 T min $R^2 = 0.77$

The result from experimentation indicated that for shoot damage during experimental period morning relative humidity (1.50) and minimum temperature (0.415) was found highly significantly superior weather conditions for shoot damage among the all other weather parameters and indicated that weather parameters influenced per cent shoot damage.

Fruit damage (weight basis) = 24.85 – 0.311 RHI + 1.76 T min $R^2 = 0.70$

The result from experimentation indicated that for fruit damage during experimental period minimum temperature (1.76) and morning relative humidity(0.311) was found highly significantly superior weather conditions for fruit damage among the all other weather parameters and indicated that weather parameters influenced fruit damage.

Fruit damage (number basis) = -33.30 – 0.966 T max -0.328 RHI R^2 = 0.70

The result from experimentation indicated that for fruit damage during experimental period morning relative humidity (0.328) and maximum temperature (0.966) was found highly significantly superior weather conditions for Fruit damage among the all other weather parameters and indicated that weather parameters influenced fruit damage.

Aphid = 49.02 -0.176 T max + 1.247 RH II R^2 = 0.68

The result from experimentation indicated that for Aphids during experimental period maximun temperature (0.176) and afternoon relative humidity (1.247) during the crop growing period was found highly significantly superior weather conditions for number of aphid among the all other weather parameters and indicated that weather parameters influenced number of aphids .

Jassid = -39.96 -0.654 T max -0.753 RH I R^2 = 0.66

The result from experimentation indicated that for jassid during experimental period maximum temperature (0.654) and morning relative humidity(0.753) during the crop growing period was found highly significantly superior weather conditions for number of jassid among the all other weather parameters and indicated that weather parameters influenced number of jassid. These experimental findings were accordance with Naresh Kumar *et al.* (2012).

Whiteflies = 2.79 +0.67 Tmin +0.11 BSS R^2 = 0.71

The result from experimentation indicated that for whiteflies during experimental period minimum temperature (0.67) and Bright sunshine hours (0.11) during the crop growing period was found highly significantly superior weather conditions for number of whiteflies among the all other weather parameters and indicated that weather parameters influenced number of whiteflies. These experimental findings were accordance with Naresh kumar *et al.* (2012).

Correlation between weather parameters and incidence of *L. orbonalis* .

The correlation of meteorological parameters with incidence of brinjal shoot damage was during in 2014 and the correlation coefficient (r) of shoot damage on brinjal with the weather parameters are presented. During 31stMW, 32nd MW, 33rd MW and 34th MW maximum temperature showed significant positive correlation with shoot damage (r=0.7647*, 0.4066, 03463 and 0.4539).Whereas morning relative humidity, rainfall and bright sunshine showed positive correlation with shoot damage. Average shoot damage showed highly significant negative correlation with minimum temperature during 31st MW, 32nd MW, 33rd MW and 34th MW (r= -0.2641,-0.3477, -0.2879 and -0.3365) respectively.

The correlation of meteorological parameters with incidence of brinjal shoot was during in 2015 and the correlation coefficient (r) of shoot borer populations on brinjal with the weather parameters are presented. During 31st MW, 32nd MW, 33rd MW and 34th MW planting windows maximum temperature showed significant positive correlation with shoot damage (r= -0.7966*, 0.4480,0.4568 and 0.3721).Average shoot damage showed highly significant negative correlation with minimum temperature during 31st MW, 32nd MW, 33rd MW and 34th MW Planting windows (r= -0.4563,-0.4416, -

0.4634 and -0.5018), respectively. Whereas morning and afternoon relative humidity and rainfall showed negative correlation with shoot damage. It was observed that, the infestation of shoot borer started increasing from August onwards and it was peak during 37th MW. It was evident from that the incidence of shoot borer in terms of percentage of infested shoots had a significant positive correlation with the maximum temperature and bright sunshine hours.

Correlation between weather parameters and incidence of *L. orbonalis* (weight basis)

The correlation of meteorological parameters with incidence of brinjal fruit borer was during in 2014. The correlation coefficient (r) of fruit damage on brinjal with the weather parameters are presented. During 31st MW, 32nd MW, 33rd MW and 34th MW Planting windows maximum temperature showed significant positive correlation with fruit damage (r= 0.7844*, 0.4764, -0.3881 and 0.3812).Whereas morning relative humidity rainfall and bright sunshine hours showed positive correlation with fruit damage.Average fruit damage showed highly significant negative correlation with minimum temperature during 31st MW, 32nd MW, 33rd MW and 34th MW Planting windows (r= -0.2988,-0.2612, -0.3228 and -0.2975) ,respectively.

Correlation between weather parameters and incidence of *Myzus persicae*.

The correlation of meteorological parameters with incidence of brinjal aphids was studied in 2014. The correlation coefficient (r) of aphids on brinjal with the weather parameters are presented. During 31st MW, 32nd MW, 33rd MW and 34th MW Planting windows maximum temperature showed significant positive correlation with aphid population (r= 0.464, 0.294^{*}, 0.293 and 0.473*).Whereas morning relative humidity, rainfall and bright sunshine showed positive correlation with aphid population. Average number of aphids showed highly significant negative correlation with minimum temperature during 31st MW, 32nd MW, 33rd MW and 34th MW Planting windows (r= -0.669*, -0.584, -0.648 and -0.627*), respectively.

The correlation of meteorological parameters with incidence of brinjal aphids was studied in 2015. The correlation coefficient (r) of aphids on brinjal with the weather parametersare presented. During 31st MW, 32nd MW, 33rd MW and 34th MW planting windows maximum temperature showed significant positive correlation with aphid population (r= 0.715*, 0.675*, 0.678 and 0.654). Whereas morning relative humidity, rainfall and bright sunshine showed positive correlation with aphid population. Average number of aphids showed highly significant negative correlation with minimum temperature during 31st MW, 32nd MW, 33rd MW and 34th MW Planting windows (r= -0.644*,-0.592*,-0.595and-0.567),respectively. It was observed that, the infestation of aphids started increasing from August onwards and it was peak during 37th and 38thMW.

Normally, the temperature also showed decreasing trend from December onwards and has the lowest during January. Hence, with miminum temperature certainly resulted in increase in the infestation of aphids. Morning and evening relative humidity was also higher in month of January which resulted in increase in aphid population. When maximum temperature increased, there was corresponding increase in brinjal aphid. Earlier research workers also carried out the work on seasonal incidence of brinjal aphid. Patel (1997) reported aphids appeared on brinjal crop during the second week of August. This was in agreement with the present finding.

Correlation between weather parameters and incidence of *A. biguttula biguttula*

The correlation of meteorological parameters with incidence of brinjal jassid was during 2014. The correlation coefficient (r) of jassid on brinjal with the weather parameters are presented.Average jassid showed highly negative correlation with minimum temperature during 31st MW, 32nd MW, 33rd MW and 34th MW Planting windows (r= -0238,-0.561,-0.429 and -0.450), respectively. During31st MW, 32nd MW, 33rd MW and 34th MW planting windows maximum temperature showed significant positive correlation with jassid population(r=0.707*,0.272,0.250 and 0.208).Whereas morning relative humidity, rainfall and bright sunshine hours showed positive correlation with aphid population.

The correlation coefficient (r) of jassid on brinjal with the weather parameters are presented (2015). During 37thMW, maximum temperature showed significant positive correlation with jassid population (r= 0.762*).Whereas morning relative humidity, rainfall and bright sunshine hours showed positive correlation with jassid population.Average number of jassids showed highly negative correlation with minimum temperature during 31st MW, 32nd MW, 33rd MW and 34th MW Planting windows (r= -0.800*,-0.315,-0.501 and -0.280),respectively. It was observed that, the infestation of jassids started increasing from August onwards and it was peak during 37th MW.

Normally, the temperature also showed decreasing trend from December onwards and has the lowest during January. Hence, with minimum temperature certainly resulted in increase in the infestation of jassid. Morning and evening relative humidity was also higher in month of January which resulted in increase in jassid population. When maximum temperature increased, there was corresponding increase in brinjal jassid. Earlier research workers also carried out the work on seasonal incidence of brinjal jassid. Patel (1997) reported jassids appeared on brinjal crop during the second week of August. This was in agreement with the present finding.

The colony buildup of jassid complex started during the second week of August and started declining in March. The jassid appeared on the 35th or 37th standard week and reached a peak in the 3rd or 4th standard week and declined thereafter before disappearing in the 7th standard week. Minimum showed significant negative correlations with jassid. These results are in accordance with the present finding. Patel (1997) reported maximum activity of jassid in the 3rd meteorological week and most suitable maximum temperature, minimum temperature and relative humidity for the pest were 20 - 25^0C, 9 - 10^0C and 80 - 85 per cent, respectively.These findings are similar with the findings of Mohd *et al*. (2013) and Rashid and Houssain (2008)

Correlation between weather parameters and incidence of *Bemisia tabaci*

The correlation of meteorological parameters with incidence of brinjal whiteflies was during in 2014. The correlation coefficient (r) of whiteflies on brinjal with the weather parameters are presented. During 31st MW, 32nd MW, 33rd MW and 34th MW planting windows maximum temperature showed significant positive correlation with whiteflies population(r=0.751*,0.592.0.582 and 0.452).Average number of whiteflies showed highly significant negative correlation with minimum temperature during 31st MW, 32nd MW, 33rd MW and 34th planting windows (r= -0.456*,-0.256,-0.216 and -0.209), respectively. Whereas morning and afternoon relative humidity and rainfall showed negative correlation with whiteflies population.

The correlation of meteorological parameters with incidence of brinjal whiteflies was during in 2015. The correlation coefficient (r) of whiteflies on brinjal with the weather parameters are presented. During 31st MW, 32nd MW, 33rd MW and 34th MW planting windows maximum temperature showed significant positive correlation with whiteflies population (r= 0.766*,0.496,0.486 and 0.455).Average number of whiteflies showed highly significant negative correlation with minimum temperature during 31st MW, 32nd MW, 33rd MW and 34th MW Planting windows (r= -0.365,-0.261,-0.220 and -0.213),respectively. Whereas morning and afternoon relative humidity and rainfall showed negative correlation with whiteflies population and positive correlation with bright sunshine hours. It was observed that, the infestation of whiteflies started increasing from August onwards and it was peak during 38th MW.

Normally, the temperature also showed decreasing trend from December onwards and has the lowest during January. Hence, with minimum temperature certainly resulted in increase in the infestation of whiteflies. Morning and evening relative humidity was also higher in month of January which resulted in decrease in whiteflies population. When maximum temperature increased, there was corresponding increase in brinjal whiteflies. Earlier research workers also carried out the work on seasonal incidence of brinjal whiteflies. Patel (1997) reported whiteflies appeared on brinjal crop during the second week of August. This was in agreement with the present findings.

The colony buildup of whiteflies complex started during the second week of August and started declining in March. The whiteflies appeared on the 35th or 37th standard week and reached a peak in the 3rd or 4th standard week and declined thereafter before disappearing in the 7th standard week. Minimum temperatures showed significant negative correlations with whiteflies. These results are in accordance with the present findings. Patel (1997) reported maximum activity of whiteflies in the 3rd meteorological week and most suitable maximum temperature, minimum temperature and relative humidity for the pest were 20 - 25^{0}C, 9 - 10^{0}C and 80 - 85 per cent, respectively.These findings are similar with the findings of Mohd *et al*. (2013) and Rashid and Houssain (2008).

Table 1 : Correlation between shoot damage of *L. orbonalis* with weather parameters during 2014

Treatments	'r' values for brinjal							
	Tmax	**Tmin**	**Av Temp**	**R H I**	**R H II**	**Av. RH**	**RF**	**B S S**
A) Hybrids								
V_1:Phule Arjun	0.5531	-0.0433	0.4861	0.1760	-0.5348	-0.4948	0.2948	0.4874
V_2:Krishna	0.4574	-0.0759	0.3630	0.1384	-0.4035	-0.4699	0.2912	0.4315
V_3:Panchganga	0.4889	-0.0911	0.3782	0.1215	-0.4261	-0.4944	0.2987	0.4391
B)Planting windows								
P_1:31 MW	0.7647*	-0.2641	0.3775	0.1227	-0.7928*	0.7565*	0.3579	0.7266*
P_2:32 MW	0.4066	-0.3477	0.2407	0.0305	-0.3994	-0.6766	0.3641	0.6276
P_3:33 MW	0.3463	-0.2879	0.3369	0.0960	-0.3039	-0.6713	0.3567	0.7047*
P_4:34 MW	0.4539	-0.3365	0.2968	0.0689	-0.4220	-0.6929	0.3636	0.6419
Mean	0.4673	-0.2066	0.3542	0.1077	-0.5118	-0.5938	0.3324	0.5513

* Significant at 5% level ** Significant at 1% level

Table 2: Correlation between Shoot damage of *L. orbonalis* with weather parameters during 2015

Treatments	'r' values for brinjal							
	Tmax	Tmin	Av Temp	R H I	R H II	Ave RH	RF	B S S
A) Hybrids								
V_1:Phule Arjun	0.5477	-0.0614	0.4633	0.1723	-0.5437	-0.5041	-0.2952	0.4973
V_2 :Krishna	0.4537	-0.0813	0.3542	0.1361	-0.5060	-0.4727	-0.2923	0.4319
V_3 :Panchganga	0.4766	-0.1001	0.3578	0.1526	-0.5308	-0.4944	-0.2487	0.4544
B)Planting windows								
P_1:31 MW	0.7966*	-0.4563	0.2208	-0.0395	-0.7912*	-0.7764*	-0.4187	0.6810
P_2:32 MW	0.4480	-0.4416	0.1812	-0.1146	-0.7537	-0.7510	-0.3336	0.7979*
P_3:33 MW	0.4568	-0.4634	0.1759	-0.0488	-0.5673	-0.5545	-0.4042	0.6438
P_4 :34 MW	0.3721	-0.5018	0.1531	-0.1399	-0.4870	-0.5871	-0.4069	0.6701
Mean	0.4931	-0.3008	0.2723	0.0169	-0.5971	-0.5915	-0.3428	0.5823

* Significant at 5% level ** Significant at 1% level

Table 3 : Correlation between *L. orbonalis* (on weight basis) with weather parameters during 2014

Treatment	'r' values for brinjal							
	Tmax	Tmin	Av Temp	R H I	R H II	Ave RH	RF	B S S
A) Hybrids								
V_1:Phule Arjun	0.5895	-0.3428	0.2627	0.2297	-0.7483	-0.7116*	0.2971	0.6575
V_2:Krishna	0.3849	-0.3761	0.2063	0.2191	-0.5626	-0.7277*	0.2848	0.6718
V_3:Panchganga	0.4616	-0.3439	0.2506	0.2244	-0.5504	-0.7146*	0.2872	0.4675
B)Planting windows								
P_1:31 MW	0.7844*	-0.2988	0.3210	0.2462	-0.7330*	-0.6934	0.2748	0.7479*
P_2:32 MW	0.4764	-0.2612	0.3663	0.2452	-0.7097*	-0.6702	0.2877	0.6343
P_3:33 MW	0.3881	-0.3228	0.2904	0.2440	-0.5440	-0.5048	0.2723	0.5513
P_4:34 MW	0.3812	-0.2975	0.3187	0.2470	-0.5319	-0.4922	0.2671	0.4504
Mean	0.4666	-0.3204	0.2880	0.2365	-0.6257	-0.6449	0.2816	0.5544

* Significant at 5% level ** Significant at 1% level

Table 4: Correlation between *L.orbonalis* (on weight basis) with weather parameters during 2015.

Treatment	'r' values for brinjal							
	Tmax	**Tmin**	**Av Temp**	**R H I**	**R H II**	**Ave RH**	**RF**	**B S S**
A) Hybrids								
V_1:Phule Arjun	0.7083*	-0.5961	0.1015	0.0661	-0.8263	-0.7969	0.6761	0.6565
V_2:Krishna	0.3972	-0.4650	0.1325	0.0484	-0.5159	-0.4848	0.3780	0.4469
V_3:Panchganga	0.3863	-0.4892	0.0809	0.0548	-0.5188	-0.4914	0.3794	0.4812
B)Planting windows								
P_1:31 MW	0.7049*	-0.5891	0.1072	0.0549	-0.8276**	-0.8001**	0.5761	0.6558
P_2:32 MW	0.6690	-0.5289	0.1472	0.0860	-0.7012*	-0.7692	0.3731	0.6420
P_3:33 MW	0.4123	-0.4115	0.1140	0.0467	-0.5106	-0.4599	0.3700	0.4189
P_4:34 MW	0.4752	-0.3767	0.0840	0.0491	-0.5313	-0.4836	0.3823	0.6546
Mean	0.5362	-0.4938	0.1096	0.0580	-0.6474	-0.6123	0.4479	0.5651

* Significant at 5% level ** Significant at 1% level

Table 5: Correlation between *L.orbonalis* (on number basis) with weather parameters during 2014

Treatment	'r' values for brinjal							
	Tmax	**Tmin**	**Av Temp**	**R H I**	**R H II**	**Ave RH**	**RF**	**B S S**
A) Hybrids								
V_1:Phule Arjun	0.6273	-0.5058	0.0706	0.1891	-0.7856*	-0.7558*	0.2860	0.6082
V_2:Krishna	0.4123	-0.4393	0.1495	0.2177	-0.5647	-0.5301	0.2864	0.5888
V_3:Panchganga	0.4098	-0.4790	0.0875	0.1917	-0.4774	-0.5472	0.2885	0.4127
B)Planting windows								
P_1:31 MW	0.7086*	-0.5015	0.0526	0.1899	-0.7804*	-0.7505*	0.2822	0.6094
P_2:32 MW	0.4294	-0.5343	0.0311	0.1814	-0.5923	-0.5639	0.2697	0.6147
P_3:33 MW	0.4415	-0.4593	0.0099	0.1711	-0.4942	-0.5675	0.2786	0.4063
P_4:34 MW	0.4611	-0.4291	0.0411	0.1807	-0.4891	-0.5608	0.2866	0.4278
Mean	0.4843	-0.4783	0.0632	0.1888	-0.5977	-0.6108	0.2826	0.5240

* Significant at 5% level   ** Significant at 1% level

Table 6: Correlation between Aphids with weather parameters during 2014

Treatment	'r' values for brinjal							
	Tmax	**Tmin**	**Av Temp**	**R H I**	**R H II**	**Ave RH**	**RF**	**B S S**
A) Hybrids								
V_1:Phule Arjun	0.748*	-0.702*	0.737	0.749*	-0.257	-0.470	0.153	0.875**
V_2:Krishna	0.378	-0.685	0.557	0.624	-0.284	-0.818	0.232	0.678
V_3:Panchganga	0.359	-0.605	0.514	0.644	-0.253	-0.499	0.387	0.649
B)Planting windows								
P_1:31 MW	0.464	-0.669	0.540	0.746*	-0.226	-0.757*	0.333	0.759*
P_2:32 MW	0.294	-0.584	0.451	0.630	-0.274	-0.477	0.129	0.045
P_3:33 MW	0.293	-0.648	0.472	0.604	-0.205	-0.446	0.235	0.146
P_4:34 MW	0.473	-0.627	0.653	0.838	-0.337	-0.466	0.287	0.038
Mean	0.377	-0.636	0.531	0.668	-0.263	-0.541	0.267	0.311

Table 7: Correlation between Jassids (*A. biguttula biguttula*) with weather parameters during 2014

Treatment	'r' values for brinjal							
	Tmax	**Tmin**	**Av Temp**	**R H I**	**R H II**	**Ave RH**	**RF**	**B S S**
A) Hybrids								
V_1:Phule Arjun	0.517	-0.710*	-0.549	0.715*	-0.532	-0.650	0.252	0.805**
V_2:Krishna	0.554	-0.325	-0.585	0.648	-0.562	-0.686	0.311	0.236
V_3:Panchganga	0.520	-0.382	-0.542	0.603	-0.538	-0.650	0.266	0.219
B)Planting windows								
P_1:31 MW	0.707*	-0.238	-0.730*	0.642	-0.752*	-0.593	0.415	0.800*
P_2:32 MW	0.272	-0.561	-0.424	0.631	-0.230	-0.407	0.092	0.096
P_3:33 MW	0.250	-0.429	-0.360	0.559	-0.241	-0.391	0.106	0.064
P_4:34 MW	0.208	-0.450	-0.584	0.735	-0.432	-0.574	0.271	0.051
Mean	0.432	-0.371	-0.496	0.619	-0.427	-0.564	0.245	0.116

* Significant at 5% level ** Significant at 1% level

Table 8 : Correlation between whiteflies with weather parameters during 2014.

Treatment	'r' values for brinjal							
	Tmax	**Tmin**	**Av Temp**	**R H I**	**R H II**	**Ave RH**	**RF**	**B S S**
A) Hybrids								
V_1:Phule Arjun	0.714*	-0.256	0.410	-0.041	-0.070	-0.073	-0.772*	0.777*
V_2:Krishna	0.126	-0.278	0.406	-0.020	-0.046	-0.047	-0.533	0.455
V_3:Panchganga	0.131	0.274	0.407	-0.024	-0.051	-0.052	-0.541	0.466
B)Planting windows								
P_1:31 MW	0.751*	-0.456	0.410	-0.041	-0.070	-0.073	-0.772*	0.777*
P_2:32 MW	0.592	-0.256	0.311	-0.035	-0.045	-0.043	-0.472	0.373
P_3:33 MW	0.582	-0.216	0.296	-0.031	-0.038	-0.050	-0.357	0.327
P_4:34 MW	0.452	-0.209	0.210	-0.035	-0.040	-0.046	-0.376	0.352
Mean	0.145	-0.262	0.409	-0.035	-0.063	-0.066	-0.362	0.171

* Significant at 5% level ** Significant at 1% level

Conclusions:

1. Amongst all the brinjal hybrids, Phule Arjun hybrids found significantly superior under extended planting windows followed by Krishna and Panchganga.
2. Planting during 31^{st} MW (1^{st} week of August) was observed to be most suitable and optimum for brinjal considering the growth and yield attributes. This planting window was at par with 32^{nd} MW planting window.
3. Linear correlation analysis for brinjal fruit yield with weather parameters was significantly positively correlated with maximum temperature and minimum temperature.
4. Timely planting during 31^{st} MW (P_1) and 32^{nd} (P_2) recorded lower incidence of shoot and fruit borer, aphids, jassid and whiteflies whereas,crop planted during 34^{th}MW (P_4) recorded maximum incidence of all pests. Among the brinjal hybrids, higher incidence was recorded with Panchganaga and minimum was recorded on Phule Arjun.
5. Among the brinjal hybrids lower incidence of shoot and fruit borer, aphids, jassids and whiteflies was recorded on hy.Phule Arjun,Which was found to be tolerant.This was followed by hy.Krishna.The higher incidence of all pests was recorded hy.panchganga,which was found to be susceptible.
6. Pest population on brinjal shoot/fruit/Aphid/Jassid/Whiteflies had significant negative correlation with minimum temperatures, whereas, morning and evening relative humidity, wind speed, pan evaporation and bright sunshine hours showed positive correlation pests population.

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