*Original Research Article*

**Integrated Pest Management Strategies for Eco-Friendly Control of Okra Shoot and Fruit Borer under Climate Variability**

**ABSTRACT**

The prevalent weather conditions in a region have a significant impact on the occurrence and subsequent growth of pest populations. For the creation of a successful pest management programme, understanding pest behaviour and population dynamics in relation to meteorological parameters is a crucial prerequisite. The study aims to evaluate the comparative efficacy of different bio-pesticides against Okra shoot and fruit borer (*Earias* spp.) under organic farming conditions in the Bundelkhand region, with a focus on Integrated Pest Management (IPM) strategies for eco-friendly pest control. The field experiment was laid out during *Kharif* season 2022-23, at instructional cum research farm located at the Experimental, Organic Research farm kargunwa ji Jhansi, Department of Entomology, Institute of Agricultural Sciences, Bundelkhand University, Jhansi (Uttar Pradesh), India. The okra variety ‘*Shalini*’ was sown comprising a total of 9 treatments with 3 replications under Randomised block design (RBD) with 3.0 m x 2.10 m (Gross) and 1.8 m x 1.8 m (Net). The observation for minimum infestation intensity (%), for scale-1 (1 bore/fruit), scale-2 (2-3 bore/fruit) scale-3, (>3 bore/fruit), and mean intensity per cent of Okra shoot and fruit borer, *Earias vittella* F. was recorded under the treatment T5 (*Bacillus thuringiensis* var.Kurstaki @ 0.05%). The maximum yield of okra was recorded highest when sprayed with bio-pesticides under the treatment T5 (*Bacillus thuringiensis* var.Kurstaki @ 0.05%) followed by the next best for maximum was recorded highest when sprayed with bio-pesticides under the treatment T4 (*Metarrhizium anisoplae* @ 0.05%), and were recorded highest when sprayed with bio-pesticides under the treatment T2 (*Beauveria bassiana* @ 0.05%). However, the minimum yield of okra was recorded lowest without being sprayed with bio-pesticides.

*Key words*: Abiotic, Bio pesticides, Okra, Population, Fruit Borer, Climate Variability

**INTRODUCTION**

Okra (*Abelmoschus esculentus* L. Monech) is a vegetable crop that is grown all over the world and is frequently referred to as "Lady's Finger." It originated in tropical Africa and is a member of the ‘Malvaceae’ family [19]. Among vegetables, okra has the most chromosomes (2n=130). Okra may be grown all year round, despite the fact that the *Kharif* season is when it is most frequently produced. In India, around six million tonnes of okra are produced annually as a fruit and vegetable. Globally, okra production in **2023** was estimated at approximately **11.5 million metric tonnes,** with India alone producing around **7.16 million metric tonnes**, reinforcing its dominance in the sector (DiverCity Times, 2024). Okra fruit is rich in vitamins (e.g., vitamin A, vitamin C, vitamin B6, folic acid, riboflavin, etc.), minerals (e.g., calcium, magnesium, potassium, iron, zinc, phosphorus, and β carotene), carbohydrates, proteins, fats and fiber (Jan et al., 2022). Insect pests pose a major threat from sowing to harvest to this important vegetable. The damage of different insect pests varies from year to year depending upon weather conditions and the intensity of insect pests' attack (Sarsaiya & Singh, 2025; Donatti-Ricalde et al., 2023; Mohapatra et al.,2022). The infamous pest known as the okra shoot and fruit borer, *Earias vittella* F., belongs to the 'Noctuidae' family and has an annual occurrence in India [2]. An adaptable and highly dispersed insect pest of okra is the okra shoot and fruit borer. From India, China, and North Australia, *Earias vittella* is a widely distributed species [4]. It has been documented in Indonesia, New Guinea, Fiji, Bangladesh, Burma, Pakistan, Sri Lanka, India, and Pakistan [5]. Being a holometabolous insect, the okra shoot and fruit borer has four life stages: egg, larva, pupa, and adult.

The fragile shoots, flower buds, and fruits of okra are penetrated by the larvae of the okra shoot and fruit borer. As a result, the attacked shoot dries up and the developing fruit buds and flower buds drop off early as per [8,10]. Affected fruits continue to grow on the plants but become unfit for human consumption. The OSFB larvae eat inside the shoots while also damaging the seed [5]. When the crop becomes three weeks old, the okra shoot and fruit borer's first visual symptom becomes apparent as the larvae bore into the shoots [17]. The top leaves wilted, and the plant's entire apex fell over when it was severely attacked. The larvae attack the flower buds, small fruits, and even mature pods during the crop's reproductive stage, reducing the production [11,13]. There are two ways that the crop can be harmed. The caterpillars first bore holes in the developing stems' terminal parts before tunnelling inside to descend. The outcome is that the shoots droop or dry out. Second, the holes made by the larvae as they enter the fruits make them unfit for human eating [14,15]. According to [12,13,20], the borer damages okra shoots by 24.6 to 26.0 per cent and fruits by 40 to 100 per cent. Okra is a more reliable source of income for farmers, but the attack of various insect pests at different phases of its growth limits the crop's ability to be successfully grown and yield. About 13 pests have been linked to okra in India [17,19].

The most harmful pests of okra are two species of shoot and fruit borer, *Earias insulana* (Boisd.) and *Earias vittella* (Fab.), whose immature larvae bore into the fragile shoot during early vegetative growth. Abiotic factor variation in the current climate change scenario is also changing the condition of insect pests [14,18]. The prevalent weather conditions in a region have a significant impact on the occurrence and subsequent growth of pest populations. For the creation of a successful pest management programme, understanding pest behaviour and population dynamics in relation to meteorological parameters is a crucial prerequisite [16]. Larvae of the okra shoot and fruit borer harm the crop both during its vegetative and reproductive stages. Accordingly, this study was conducted to determine the relationship between pest population and weather parameters in order to determine the most favourable conditions for the development of pest management strategies.

**MATERIALS AND METHODS**

A field study was conducted during the *kharif* season of 2022-23 entitled "Eco-Friendly Management of Shoot and Fruit Borer in Okra Under Climate Variability" was carried out at the Experiment, Organic research farm Kargunwa Ji, Institute of Agricultural Sciences, Department of Entomology, Bundelkhand University, Jhansi, Uttar Pradesh.The harvested fruits of each plot was carefully observed after each picking to ascertain fruit infestation and percentage fruit infested was worked out. The data on per cent fruit damage was statistically analyzed after suitable transformation.

**Relationship between insect pest population and morphological characters of okra.**

To study the relationship between okra shoot and fruit borer (*Earias* spp.) and morphological characters of okra in different treatment combinations during *Kharif* 2022-2023.The observations, like the numbers of fruits /plants recorded at each picking. The simple correlation was carried out to study the relationship between okra shoot and fruit borer (*Earias* spp.) and the morphological characters of okra.

**LIST 1.** The details of the field experiment are as follows:

|  |
| --- |
| **Location** : Organic Research farm, Kargunwa Ji, B.U. Jhansi.  |
| **Crop**  : Okra |
| **Variety**  : ‘Shalini’ |
| **Design** : **Randomis**ed Block Design (RBD) |
| **Replication**  : 03 |
| **Treatment** :10 |
| **Plot size**  : 3.0 m × 2.10 m (Gross) 1.8 m × 1.8 m (Net) |
| **Spacing**  : 60 cm × 45 cm (Row to row and plant to plant) |

**Statistical analysis**

All the recommended cultural practices and plant protection measures were followed throughout the experimental periods at pertinent stages of the okra cultivar were statistically analysed using (ANOVA for Randomised Block Design (RBD). Correlation and regression between abiotic factors and okra major insect pest population were worked out by using the formula as suggested by [18]. The correlation coefficient between two variables *X* and *Y* is usually denoted by t is a numerical measure of the liner relationship of two variables and is given by the ratio of covariance between the two variables *X* and *Y* to the product of the standard deviation of both variables *X* and *Y*. Symbolically,

P (x,y) = cov (x,y)/σX.σY

Here, cov is the covariance. σX is the standard deviation of X, and σY is the standard deviation of Y. The given equation for the correlation coefficient can be expressed in terms of means and expectations.

µx and µy are the mean of x and the mean of y, respectively. E is the expectation.

$$p\left(X,Y\right)= E\left(X-µx\right)-\frac{\left(Y-µy\right)}{σx.σy}$$

Fruit infestation and yield (q /ha) was worked out with the help of following formula.

Per cent fruit infestation = Number of damaged fruits × 100

Total number of fruit (Healthy + Damage)

Fruit yield = weight of fruit (kg per plot)

 Plot area (m2)

**RESULTS AND DISCUSSION**

## Mean population of Okra shoot and fruit borer, *Earias vittella* F. at first spray.

The highest mean population (20.687) before spray of bio-pesticides was recorded in T5 (*Bacillus thuringiensis* var.Kurstaki), which was statistically different from all other treatments (Table 1). The lowest mean population was (18.637) before the spray of bio-pesticides was recorded in T9 (Control). Moreover, after spray of bio-pesticides for the first spray at (3rd, 7th and 10th) days the lowest mean population was (18.250, 17.300 and 15.930) recorded under the treatment T4 (*Metarrhizium anisoplae* @ 0.05%) The present study revealed the lowest mean population observed when sprayed with bio-pesticides regarding the mean population [9] which is partly comparable with our current result.

## Shoot infestation (%)

The highest mean Shoot infestation (%) of Okra shoot and fruit borer, *Earias vittella* F. was (32.880, 13.693, 11.353 and 16.427) % at vegetative stage,early fruiting stage, late fruiting stage and mean infestation without spray of bio-pesticides was recorded in T9 (Control) which was statistically different from all other treatments (Table 2). The present results signify that on spray of bio-pesticides at different stages of okra Shoot infestation (%) of Okra shoot and fruit borer, *Earias vittella* F. is reduced further, and the results are supported by [7,9].

## Infestation intensity (%).

The maximum infestation intensity (%), for scale-1 (1 bore/fruit), scale-2 (2-3 bore/fruit) scale-3, (>3 bore/fruit) and mean intensity per cent of Okra shoot and fruit borer, *Earias vittella* F. was (24.133, 11.090, 8.333 and 35.700) % recorded under the treatment T9 (Control) at (Table 3). The observation for minimum infestation intensity (%), for scale-1 (1 bore/fruit), scale-2 (2-3 bore/fruit) scale-3, (>3 bore/fruit) and mean intensity per cent of Okra shoot and fruit borer, *Earias vittella* F. was (8.800, 5.557, 3.223 and 13.367) % recorded under the treatment T5 (*Bacillus thuringiensis* var.Kurstaki @ 0.05%). Similarly, the next best was observed (10.800, 7.133, 4.577 and 15.650) % recorded under the treatment T2 (*Beauveria bassiana* @ 0.05%). From the above-mentioned findings, it was revealed that the T1 performed as the best treatment in terms of reducing the infestation intensity of Okra shoot and fruit borer, *Earias vittella* F. over control due to application of different bio-pesticides, followed by T5 and T2. On the other hand, the maximum infestation intensity of Okra shoot and fruit borer, *Earias vittella* F. was recorded in T9. Furthermore, [10,12] also found that spray of bio-pesticides was effective against okra shoot and fruit borer as well as increased yield, which supports the present study findings.

## Yield contributing characters.

The maximum length of healthy fruit (cm), length of infested fruit (cm), girth of healthy fruit (cm) and girth of infested fruit (cm) of Okra shoot and fruit borer, *Earias vittella* F. was (23.667, 27.800, 5.767 and 3.610) cm recorded under the treatment T1 (NSKE@ Crude extract at 0.05%) at (Table 4). The next best observation for maximum length of healthy fruit (cm), length of infested fruit (cm), girth of healthy fruit (cm) and girth of infested fruit (cm) was (22.567, 24.867, 5.500 and 3.503) cm recorded under the treatment T4 (*Metarrhizium anisoplae* @ 0.05%) followed by (21.227, 23.967, 5.410 and 2.787) cm recorded under the treatment T2 (*Beauveria bassiana* @ 0.05%). [7,12]also found that spray of bio-pesticides was effective against okra shoot and fruit borer as well as increased yield, which supports the present study findings.

**Seasonal incidence and Population dynamics of Okra shoot and fruit borer, *Earias vittella* F.**

The population of Okra shoot and fruit borer, *Earias vittella* F**.**crop along with meteorological observation during *Kharif* season 2022, has been presented in Table 5). The data showed that the population of Okra shoot and fruit borer, *Earias vittella* F appeared on 1st July and continued till the first week of October. The number of larval periods per plant varied from 0.23 to 5.78, whereas the number of borers per plant ranged from 0.00 to 34.98. The larval population was low during the month of July and varied between 0.23 to 5.78 larvae/plant. The pest population increased from 1st July and reached its peak (5.78 larvae/plant) 35th week of August. The pest population declined thereafter and varied from 3.99 to 3.24 larvae /plant. During this period mean temperature and relative humidity ranged from 39.0 to 41.4 and 33.0 to 37.0 per cent, respectively. The Population of pests suddenly decreased in late September, perhaps due to the reason that no new leaves are produced. The Population was high in the absence of rain. These observations are close agreement with the earlier findings of [10] also reported the mean shoot damage ranged from 1.1 per cent (2nd week of September) to 28.2 per cent (4th week of August), while the fruit damage ranged from 10.0 (1st week of July) to 52.2 (1st week of October). In general, the shoot and fruit damage showed an increasing trend toward the end of year *i.e.* during winter months. The correlation studies between the population of Okra shoot and fruit borer, *Earias vittella* F. with weather parameters showed significantly positive correlation with minimum and maximum temperature (r = 0.136 and 0.344, respectively) however, negative correlation was found with relative humidity (r = -0.222) and rainfall (r = 0.229). Similar findings have been studied by [11], who noticed the seasonal incidence and its management in okra,

**CONCLUSION**

 It is much clearer from our study that the post-treatment (1st Spray was most effective in control of Okra shoot and fruit borer, *Earias vittella* F. The overall conclusion might be recorded that for reducing the shoot infestation, infestation intensity and yield contributing characters, Infestation intensity (%) based on scale and for yield parameters treatment, it was revealed that the T2 (*Beauveria bassiana*), T4 (*Metarrhizium anisoplae*)and T5 (*Bacillus thuringiensis* var.Kurstaki) at fixed concentration of (0.05%) performed as the best treatment in terms of increasing the yield of okra over the control due to application of different bio-pesticides. However, these results are preliminary and will require more testing to provide more consistent results in the farmer field.

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**CONFLICT OF INTEREST**

The authors declare that there is no conflict of interest.

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**Table 1. Okra shoot and fruit borer, *Earias vittella* F.** **population/5 plants at first spray of different biopesticides.**

|  |  |  |  |
| --- | --- | --- | --- |
|  **TREATMENTS** | **Conc.%** |  **Pre-treatment**  |  **Post treatment (1st Spray)**  |
| **3rd day** | **7th day** | **10th day** |
|  |  |  | Mean  |  | Mean  |  | Mean  |  | Mean  |  |
| T1 | NSKE@ Crude extract  | 0.05% | 19.887 | (0.178) | 19.107 | (0.228) | 18.213 | (0.2530 | 17.380 | (0.293) |
| T2 | *Beauveria bassiana*  | 0.05% | 20.630 | (0.336) | 18.643 | (0.299) | 16.887 | (0.053) | 14.243 | (0.030) |
| T3 | *Verticillium lecanii* | 0.05% | 20.600 | (0.624) | 19.593 | (0.426) | 18.230 | (0.537) | 16.553 | (0.484) |
| T4 | *Metarrhizium anisoplae*  | 0.05% | 19.190 | (0.287) | 18.250 | (0.217) | 17.300 | (0.174) | 15.930 | (0.136) |
| T5 | *Bacillus thuringiensis* var.Kurstaki  | 0.05% | 20.687 | (0.294) | 18.917 | (0.199) | 17.773 | (0.174) | 16.153 | (0.094) |
| T6 | Panchagavya | 0.05% | 20.593 | (0.334) | 19.913 | (0.440) | 19.170 | (0.331) | 18.187 | (0.367) |
| T7 | Neem oil  | 0.05% | 20.040 | (0.214) | 19.253 | (0.214) | 18.040 | (0.044) | 16.707 | (0.087) |
| T8 | Tobacco extract | 0.05% | 20.153 | (0.360) | 19.653 | (0.261) | 18.750 | (0.093) | 18.237 | (0.344) |
| T9 | Control |  Water spray | 18.637 | (0.260) | 20.373 | (0.348) | 21.127 | (0.451) | 23.033 | (0.035) |
|  | SE (m) ± |  | 0.354 | 0.320 | 0.276 | 0.267 |
|  | C.D.(*p=*0.05) |  | 1.070 | 0.968 | 0.833 | 0.806 |

Figures in the parentheses are transformed values √𝑥 + 0.5 values

**Table 2. Effect of different bio-pesticides on okra shoot and fruit borer shoot infestation at different growth stage of Okra.**

|  |  |  |
| --- | --- | --- |
|  **TREATMENTS** | **Conc.%** | **% Shoot infestation** |
| **Vegetative stage** | **Early fruiting stage** | **Late fruiting stage** | **Mean infestation** |
|  |  |  | Mean  |  | Mean  |  | Mean  |  | Mean  |  |
| T1 | NSKE@ Crude extract  | 0.05% | 8.637 | (6.502) | 2.603 | (0.333) | 2.993 | (0.007) | 2.293 | (0.020) |
| T2 | *Beauveria bassiana*  | 0.05% | 11.750 | (5.835) | 4.870 | (0.100) | 3.107 | (0.015) | 0.617 | (0.034) |
| T3 | *Verticillium lecanii* | 0.05% | 18.330 | (2.390) | 10.443 | (0.227) | 8.190 | (0.012) | 11.610 | (0.042) |
| T4 | *Metarrhizium anisoplae*  | 0.05% | 14.130 | (6.725) | 4.563 | (0.033) | 8.200 | (0.017) | 5.267 | (0.009) |
| T5 | *Bacillus thuringiensis* var.Kurstaki  | 0.05% | 3.033 | (7.682) | 0.527 | (0.027) | 0.430 | (0.015) | 3.193 | (0.015) |
| T6 | Panchagavya | 0.05% | 13.197 | (0.023) | 2.267 | (0.037) | 1.653 | (0.027) | 4.843 | (0.009) |
| T7 | Neem oil  | 0.05% | 11.797 | (0.127) | 2.243 | (0.013) | 6.240 | (0.010) | 8.720 | (0.015) |
| T8 | Tobacco extract | 0.05% | 25.407 | (0.483) | 7.690 | (2.980) | 11.040 | (0.020) | 7.690 | (0.017) |
| T9 | Control |  Water spray | 32.880 | (0.220) | 13.693 | (0.023) | 11.353 | (0.015) | 16.427 | (0.438) |
|  | SE (m) ± |  | 3.461 | 1.017 | 0.009 | 0.148 |
|  | C.D.(*p=*0.05) |  | 10.466 | 3.077 | 0.027 | 0.448 |

Figures in the parentheses are transformed values √𝑥 + 0.5 values

**Table 3 Effect of different bio-pesticides on okra shoot and fruit borer infestation intensity at different scales of Okra.**

|  |  |  |
| --- | --- | --- |
|  **TREATMENTS** | **Conc.%** | **Infestation intensity (%)** |
| **Scale-1** **(1 bore/fruit)** | **Scale-2** **(2-3 bore/fruit)** | **Scale-3** **(>3 bore/fruit)** | **Mean intensity (%)** |
|  |  |  | Mean  |  | Mean  |  | Mean  |  | Mean  |  |
| T1 | NSKE@ Crude extract  | 0.05% | 18.680 | 0.510 | 8.440 | 0.380 | 5.393 | 0.333 | 20.167 | 0.260 |
| T2 | *Beauveria bassiana*  | 0.05% | 10.800 | 0.600 | 7.133 | 1.033 | 4.577 | 0.487 | 15.650 | 0.384 |
| T3 | *Verticillium lecanii* | 0.05% | 18.933 | 0.167 | 10.297 | 0.627 | 7.633 | 0.037 | 17.500 | 1.358 |
| T4 | *Metarrhizium anisoplae*  | 0.05% | 11.600 | 0.650 | 7.653 | 0.503 | 4.793 | 0.133 | 19.317 | 0.622 |
| T5 | *Bacillus thuringiensis* var.Kurstaki  | 0.05% | 8.800 | 0.283 | 5.557 | 0.023 | 3.223 | 0.167 | 13.367 | 0.275 |
| T6 | Panchagavya | 0.05% | 24.900 | 0.900 | 9.483 | 0.423 | 6.457 | 0.203 | 25.200 | 1.082 |
| T7 | Neem oil  | 0.05% | 15.917 | 0.350 | 8.013 | 0.107 | 5.717 | 0.163 | 21.950 | 1.021 |
| T8 | Tobacco extract | 0.05% | 21.747 | 2.077 | 7.667 | 0.004 | 5.783 | 0.003 | 25.867 | 1.733 |
| T9 | Control |  Water spray | 24.133 | 1.733 | 11.090 | 0.020 | 8.333 | 0.227 | 35.700 | 0.305 |
|  | SE (m) ± |  | 0.941 | 0.354 | 0.234 | 0.974 |
|  | C.D.(*p=*0.05) |  | 2.845 | 1.069 | 0.709 | 2.945 |

Figures in the parentheses are transformed values √𝑥 + 0.5 values

**Table 4. Effect of different bio-pesticides on okra shoot and fruit borer infestation at different yield stages of Okra.**

|  |  |  |
| --- | --- | --- |
|  **TREATMENTS** | **Conc.%** | **Yield contributing characters** |
| **Length of healthy fruit (cm)** | **Length of infested fruit (cm)** | **Girth of healthy fruit (cm)** | **Girth of infested fruit (cm)** |
|  |  |  | Mean  |  | Mean  |  | Mean  |  | Mean  |  |
| T1 | NSKE@ Crude extract  | 0.05% | 18.033 | (0.067) | 23.100 | (0.404) | 5.097 | (0.015) | 2.467 | (0.086) |
| T2 | *Beauveria bassiana*  | 0.05% | 21.227 | (0.087) | 23.967 | (0.244) | 5.410 | (0.010) | 2.787 | (0.091) |
| T3 | *Verticillium lecanii* | 0.05% | 18.100 | (0.577) | 22.497 | (1.202) | 5.407 | (0.030) | 2.007 | (0.013) |
| T4 | *Metarrhizium anisoplae*  | 0.05% | 22.567 | (0.970) | 24.867 | (1.217) | 5.500 | (0.019) | 3.503 | (0.030) |
| T5 | *Bacillus thuringiensis* var.Kurstaki  | 0.05% | 23.667 | (0.203) | 27.800 | (0.203) | 5.767 | (0.007) | 3.610 | (0.020) |
| T6 | Panchagavya | 0.05% | 19.433 | (0.034) | 19.767 | (0.361) | 5.127 | (0.018) | 2.480 | (0.314) |
| T7 | Neem oil  | 0.05% | 19.433 | (0.809) | 21.433 | (0.907) | 5.123 | (0.258) | 2.607 | (0.047) |
| T8 | Tobacco extract | 0.05% | 20.300 | (0.115) | 18.600 | (0.437) | 5.057 | (0.035) | 1.853 | (0.023) |
| T9 | Control | Water spray | 17.433 | (0.203) | 14.333 | (0.393) | 3.807 | (0.108) | 1.753 | (0.043) |
|  | SE (m) ± |  | 0.503 | 1.349 | 0.098 | 0.113 |
|  | C.D.(*p=*0.05) |  | 1.520 | 4.079 | 0.296 | 0.342 |

Figures in the parentheses are transformed values √𝑥 + 0.5 values

**Table 5. Population dynamics of Okra shoot and fruit borer, *Earias vittella* F.** **and weather parameters during crop period 2022.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Standard week** | **Date** |  **No. of larval period** | **No.of borer/plant** | **Temperature** | **Humidity %** | **Wind Velocity** | **Rainfall (mm)** | **Evaporation (mm)** |
| **Max** | **Min** | **Morning** | **Evening** |
| 1. | 28 | 01-07-22 July. | 0.23 | 0.00 | 46.5 | 44.0 | 67.0 | 30.0 | 3.7 | 00.0 | 3.8 |
| 2. | 29 | 08-07-22 July. | 0.98 | 8.00 | 45.0 | 40.5 | 54.0 | 32.0 | 3.8 | 15.8 | 3.8 |
| 3. | 30 | 15-07-22 July. | 3.78 | 10.00 | 40.0 | 37.0 | 93.0 | 54.0 | 3.1 | 28.8 | 3.4 |
| 4. | 31 | 22-07-22 July. | 3.99 | 13.00 | 41.4 | 37.0 | 95.0 | 47.0 | 3 | 00.0 | 3.1 |
| 5. | 32 | 29-07-22 July. | 3.24 | 34.98 | 39.0 | 33.0 | 93.0 | 58.0 | 3.3 | 00.0 | 2.9 |
| 6. | 33 | 05-08-22 August. | 5.11 | 30.00 | 38.0 | 36.5 | 93.0 | 54.0 | 4.4 | 59.4 | 2.5 |
| 7. | 34 | 12-08-22 August | 5.54 | 28.00 | 38.2 | 29.5 | 95.0 | 57.0 | 3.6 | 91.0 | 2.5 |
| 8. | 35 | 19-08-22 August. | 5.78 | 23.00 | 34.2 | 31.8 | 97.0 | 79.0 | 4.6 | 51.4 | 1.6 |
| 9. | 36 | 26-08-22 August. | 5.16 | 21.1 | 34.5 | 31.0 | 97.0 | 79.0 | 2.3 | 3.6 | 2.0 |
| 10. | 37 | 02-09-22 September. | 5.10 | 18.4 | 36.5 | 32.0 | 95.0 | 41.1 | 2.7 | 24.3 | 2.4 |
| 11. | 38 | 09-09-22 September. | 5.09 | 16.12 | 34.0 | 30.0 | 100.0 | 78.0 | 3.5 | 55.8 | 2.1 |
| 12. | 39 | 16-09-22 September. | 5.06 | 16.14 | 35.0 | 29 | 94.2 | 73.0 | 2.4 | 120.0 | 2.9 |
| 13. | 40 | 23-09-22 September. | 5.64 | 23.00 | 37.0 | 34.0 | 100.0 | 73.0 | 4.6 | 100.6 | 1.6 |
| 14. | 41 | 30-09-22 September. | 5.16 | 21.1 | 34.5 | 29.0 | 100.0 | 73.0 | 2.3 | 00.0 | 2.0 |
| 15. | 42 | 07-09-22 September. | 5.13 | 18.4 | 34.5 | 26.0 | 100.0 | 72.0 | 2.7 | 164.4 | 2.4 |
| 16. | 43 | 14-09-22 September. | 5.09 | 16.14 | 36.5 | 29.1 | 100.0 | 62.0 | 3.5 | 59.4 | 2.1 |
| 17. | 44 | 21-09-22 September. | 4.09 | 16.16 | 34.5 | 29.3 | 100.0 | 62.0 | 3.5 | 59.0 | 2.5 |
| 18. | 45 | 28-09-22 September. | 4.05 | 16.18 | 35.5 | 29.4 | 100.0 | 62.0 | 3.5 | 59.3 | 2.3 |
| 19. | 46 | 04-10-22 October. | 4.04 | 16.02 | 36.2 | 29.5 | 100.0 | 62.0 | 3.5 | 59.5 | 2.0 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Range of diff. weather parameter** | 29.5-46.5 | 30.0-100 | 79-90 | 42-65 | 2.4-4. | 1.6-3.8 |
|  **Mean** | 44.14% | 25.3125 | 9.1875 | 86.3125 | 51.625 | 0.1875 | 3.06875 |
| **SD** | 24.527 | 3.122 | 2.771 | 2.469 | 6.801 | 0.544 | 0.705 |
| **Correlation** | -0.069NS | 0.809\*\* | 1.000 | -0.392NS | -0.436NS | 0.041NS | 0.802\*\* |
| **SE of ‘r’** | 6.103 | 0.780 | 0.693 | 0.617 | 1.700 | 0.136 | 0.176 |
| **cal t-value** |  | -0.415 | -0.232 | 0.105 | -0.706 | -0.603 | 0.178 |