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Short communication

Effect of net house, mulching and weather parameters on whitefly (*Bemisia tabaci* Genn.) of okra (*Abelmoschus esculentus* L. Moench) in Nepal

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Vegetables contribute 9.71% to Nepal's agricultural GDP (MOAD, 2015), covering 297,195 ha with 4.27 million mt output (AICC, 2019). Okra (*Abelmoschus esculentus*), a Malvaceae crop valued for food and medicine (Gemede *et al.,* 2015), covers 10,694 ha, producing 113,676 t (11 t ha^{-1}), mainly in Jhapa, Morang, and Chitwan (MOAD, 2018). Okra crop is attacked by several insect pests, of which shoot and fruit borer, jassid, whitefly, aphid and mite are major ones infecting okra crop during different growth stages and seasons (Dabhi *et al.,* 2013; Das *et al.,* 2011). Whitefly (*Bemisia tabaci*), a major "supervector" (Polston *et al.,* 2014; Gilbertson *et al.,* 2015), spreads over 150 viruses (Jones, 2003) and is influenced by weather conditions. Whitefly population in okra was positively and significantly correlated with minimum temperature, relative humidity, vapour pressure, and wind speed in Gujarat, India (Das *et al.,* 2011). Natural enemies help suppress populations but are limited by dust, ants, and insecticides. Management strategies include polythene mulches (Csizinszky *et al.,* 1995), shaded net houses with better light and water use (Shahak, 2008; Kittas *et al.,* 2009), and careful pesticide use within integrated pest management. Overuse of chemicals harms ecosystems and human health, highlighting the need for ecology-based, multi-strategy approaches.

A field study was conducted at Horticulture farm, Agriculture and Forestry University, Chitwan, Nepal during June–August 2017. Whitefly populations were monitored at weekly interval using yellow sticky traps inside and outside a 40-mesh net house. The experiment used a completely randomized block design with five treatments (Table 1), four replicates, and 40 plants per 3.2×3.0 m plot, with ten plants randomly tagged per plot for data collection. The weather data (temperature, rainfall, humidity) recorded at the National Maize Research Programme, Rampur, Chitwan was also used.

A net house of 4×15.3 m² with 40-mesh net was used to grow US 7109 F1 hybrid okra (BASF, Nunhems), with vigorous, erect growth and 3–4 lateral branches. Whiteflies were monitored via sticky traps to study relationships with weather parameters. Fruit yield, weight, length, and diameter were recorded, and damaged fruits were quantified with respect to various weather factors. Data were compiled and analyzed using ANOVA in R Studio, with DMRT at 5% significance. Population reduction was calculated using modified Abbott's formula.

$$\text{PROC (\%)} = 1\text{-}\{T_a \times \mathbf{C}_b)/ (T_b \times \mathbf{C}_a)\} \times 100$$

Where, PROC=Population reduction over control, T_a=population of insects after treatment application, T_b=population of insects before treatment application, C_a=population of insects in control after treatment application, C_b=population of insects in control before treatment application. Yield comparison between different treatments was done by using the increase in yield over control as follows:

Increase in yield over control (%) = (T-C) ×100/C

Where, T=yield from treated plot, C=yield from untreated plot.

Fig. 1 shows the weekly weather parameters along with the whitefly population during the entire research period. The maximum

Table 1: Treatment details

Treatments	Detail
T_1	Control (no mulch + no net + no pesticide spray)
T_2	Black polythene mulch + Nitenpyram 10% SL @ 0.5 ml/L water
T_3	Reflective polythene mulch (25 micron)
T_4	Black polythene mulch (25 micron)
T_5	Net (40 mm mesh) + black polythene mulch

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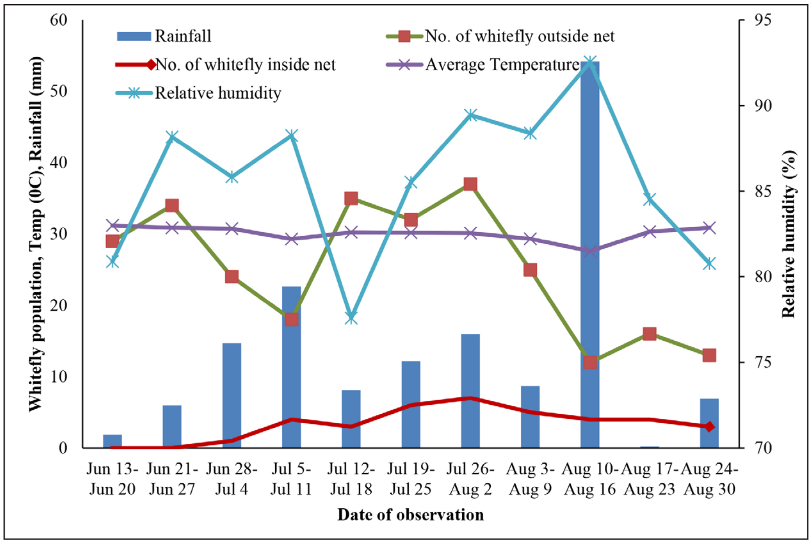

Fig. 1: Weekly whitefly population and meteorological data during crop period

Table 2: Effect of different treatments on yield-attributing characters of okra

Treatments	Number of fruits per plant	Per fruit weight (gm)	Length of fruits (cm)	Diameter of fruits (mm)
Reflective polythene mulch	45.6[ab]	13.83[ab]	16.63[a]	15.20[b]
Black polythene mulch + Nitenpyram 10% SL (0.5ml/lt water)	45.2[b]	13.32[b]	13.99[b]	15.07[b]
Black polythene mulch	41.03[c]	12.96[b]	13.75[b]	13.35[c]
Net + Black polythene mulch	47.4[a]	15.21[a]	18.18[a]	18.23[a]
Control	35.78[d]	12.57[b]	13.43[b]	12.09[d]
Mean	43.0	13.58	15.20	14.79
SEM (±)	1.95	0.90	1.53	0.47
LSD at 0.05	2.15	1.46	1.91	1.06
CV (%)	3.24	6.97	8.14	4.64
F value	44.740	4.670	11.510	45.613
P value	<0.001	<0.001	<0.001	<0.001
Significance	S	S	S	S

SEM: Standard Error of Mean; CV: Coefficient of Variation; LSD: Least Significant Difference; values with the same letters in a column are not significantly different at the 5% level of significance by DMRT (Duncan's Multiple Range Test). NS-Non-Significant, S-Significant

Table 3: Effect of different treatments on yield of okra

Treatments	Total yield (t ha^{-1})	Virus damaged fruits (t ha^{-1})	Other unmarketable fruits (t ha^{-1})
Reflective polythene mulch	26.27[b]	0.249[c]	0.53[bc]
Black polythene mulch + nitenpyram 10% SL (0.5ml/lt water)	25.04[b]	0.229[c]	0.41[c]
Black polythene mulch	22.17[c]	0.967[b]	0.72[b]
Net + black polythene mulch	30.04[a]	0.000[c]	0.03[d]
Control	18.77[d]	1.79[a]	0.99[a]
Mean	24.46	0.65	0.54
SEM (±)	3.30	0.095	0.019
LSD at 0.05	2.80	0.47	0.21
CV (%)	7.42	47.5	25.75
F value	21.912	22.963	27.128
P value	<0.001	<0.001	<0.001
Significance	S	S	S

SEM: Standard Error of Mean; CV: Coefficient of Variation; LSD: Least Significant Difference; values with the same letters in a column are not significantly different at the 5% level of significance by DMRT (Duncan's Multiple Range Test). NS-Non-Significant, S-Significant population of whitefly outside the net house (37) and inside the net house (7) was observed after 10 weeks of sowing when the average temperature was 30.1^{0}C, the humidity was 89%, and rainfall was 16.0 mm. The lowest population of whiteflies was recorded outside the net 11 weeks after sowing when the temperature was 27.6^{0}C, the humidity was 92%, and the rainfall was 54.2 mm (Fig. 1).

The highest whitefly numbers on yellow sticky traps were recorded 10 weeks after sowing, in late July, consistent with Dabhi (2007), who observed peaks during the 9th–11th weeks. Populations declined thereafter, as younger plants are more susceptible. The lowest counts coincided with maximum rainfall (54.2 mm), supporting findings from Horowitz (1986) in Sudan, where heavy rains reduced whitefly populations.

Fruit yield and quality were highest in net house with black polythene mulch (47.4 fruits/plant; 15.21 g/fruit; 18.18 cm length; 18.23 mm diameter), followed by reflective mulch and black mulch with pesticide, which were statistically similar. Lowest counts and smallest fruits were observed in the control (35.78 fruits/plant; 12.57 g; 13.43 cm; 12.09 mm) and black polythene mulch alone (41.03 fruits/plant; 12.96 g; 13.75 cm; 13.35 mm) as per Table 2.

Table 3 shows that the highest yield was in the net house with black polythene mulch (30.04 t ha^{-1}), followed by reflective mulch (26.27 t ha^{-1}) and black mulch with pesticide (25.04 t ha^{-1}). The lowest were in control (18.77 t ha^{-1}) and black mulch (22.17 t ha^{-1}).

Higher okra yield in net houses with black polythene mulch was due to reduced pest and disease pressure and favorable root-zone conditions. Although first anthesis, flowering, and initial harvest were delayed by lower light intensity (Dada and Adejumo, 2015), the last harvest lasted longer, and fruit number, size, and weight were higher. The okra plants grown under net houses in reduced light intensities were still fruiting later than those under high light intensity. Despite later fruiting, net house plants produced more fruits overall than those under full light. Reflective mulch increased yield by 39.1%, black mulch with pesticide by 31.6%, and black mulch alone by 17.9%, outperforming bare plots (Bhaduria and Kumar, 2006; Gemede *et al.,* 2015; Jha *et al.,* 2018). Weather affected whitefly populations. Reflective polythene mulch and net houses reduced infestation and increased yield. Sustainable use requires community-level polythene recycling, offering an eco-friendly alternative to chemical pesticides in okra production.

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REFERENCES

AICC (2019). Agriculture Diary. Agriculture Information and Communication Centre, Department of Agriculture, Harharbhawan, Lalitpur, Nepal.

Bhaduria, H.S. and Kumar, V. (2006). Effect of mulching on growth and productivity of okra (*Abelmoschus esculentus*) Moench under saline irrigation condition. *Amer. J. Pl. Physio.,* 1 (2): 214-216. https://doi.org/10.3923/ajpp.2006.214.216

Csizinszky, A.A., Schuster, D.J. and Kring, J.B. (1995). Color mulches influence yield and insect pest populations in tomatoes. *J. Am. Soc. Horti. Sci.,* 120: 778-784. https://doi.org/10.21273/JASHS.120.5.778

Dabhi, M.V. (2007). Succession population dynamics and management of major insect pests of okra. M. Sc. (Agri) thesis, Anand Agricultural University, Anand.

Dabhi, M. V., D. J. Koshiya, and D. M. Korat. (2013). Effect of abiotic factors on population of aphid and damage by shoot & fruit borer in okra during summer and kharif season at Anand in Gujarat. *J. Agrometeorol.,* 15(1): 71-74. https://doi.org/10.54386/jam.v15i1.1446

Dada, V. and Adejumo, S.A. (2015). Growth and Yield of Okra (*Abelmoschus esculentus* Moench) as Influenced by Compost Application under Different Light Intensities. *Notu. Scientia. Bio.,* 7 (2): 217-226. https://doi.org/10.15835/nsb729437

Das, Sevak, Vyas Pandey, H. R. Patel, and K. I. Patel. (2011). Effect of weather parameters on pest-disease of okra during summer season in middle Gujarat. *J. Agrometeorol.,* 13(1): 38-42. https://doi.org/10.54386/jam.v13i1.1331

Gemede, H.F., Retta, N., Haki, G.D., Woldegiorgis, A.Z. and Beyene, F. (2015) Nutritional Quality and Health Benefits of Okra (*Abelmoschus esculentus*), A Review. *Int. J. Nut. Food. Sc.,* 25: 16-25. https://doi.org/10.11648/j.ijnfs.20150402.22

Gilbertson, R.L., Batuman, O., Webster, C.G. and Adkins, S. (2015). Role of the insect supervectors *Bemisia tabaci* and *Frankliniella occidentalis* in the emergence and global spread of plant viruses. *Ann. Rev. Virol.,* 2: 67-93. https://doi.org/10.1146/annurev-virology-031413-085410

Horowitz, A.R. (1986). Population dynamics of *Bemisia tabaci* (Gennadius), with special emphasis on cotton fields. *Agri. Eco. Env.,* 17: 37-47. https://doi.org/10.1016/0167-8809(86)90025-3

Jha, R.K., Neupane, R.B., Khatiwada, A., Pandit, S. and Dahal, B.R. (2018). Effect of different spacing and mulching on growth and yield of Okra (*Abelmoschus esculentus* L.) in Chitwan, Nepal. *J. Agri. Nat. Res.,* 1 (1): 168-178. https://doi.org/10.3126/janr.v1i1.22232

Jones, D.R. (2003). Plant viruses transmitted by whiteflies. *Eur. J. Pl. Patho.,* 109: 195-219. https://doi.org/10.1023/A:1022846630513

Kittas, C., Rigakis, N., Kasoillas, N. and Bartzanas, T. (2009). Influence of shading screens on microclimate, growth and productivity of tomato. *Ac. Horti.,* 807: 97-102. https://doi.org/10.17660/ActaHortic.2009.807.10

MoAD, (2015). “Selected indicators of Nepalese agriculture and population”. Ministry of Agricultural Development, Agribusiness Promotion and Statistics Division, Singh Durbar, Kathmandu, Nepal.

MoAD, (2018). “Statistical Information on Nepalese Agriculture 2073/74 (2016/17)”. Ministry of Agricultural Development, Agribusiness Promotion and Statistics Division, Singh Durbar, Kathmandu, Nepal.

Polston, J.E., De Barro, P. and Boykin, L.M. (2014). Transmission specificities of plant viruses with the newly identified species of the *Bemisia tabaci* species complex. *Pest Man. Sc.,* 70: 1547-1552. https://doi.org/10.1002/ps.3738

Shahak, Y. (2008). Photo-selective netting for improved performance of horticultural crops. A review of ornamental and vegetable studies carried out in Israel. *Acta Horti.,* 770: 161-168. https://doi.org/10.17660/ActaHortic.2008.770.18