The Andhra Agric. J 69 (1): 145-149, 2022

Compatibility of Biorationals with Certain Agrochemicals and their Phytotoxicity on Blackgram

Keywords: *Blackgram, Biorationals, Compatibility, Foliar Nutrient and Phytotoxicity.*

Blackgram (*Vigna mungo* L.) is a major pulse crop grown in India throughout the year under a variety of agro-climatic conditions. In India, the total production of black gram is 2.34 million tonnes under an area of 4.67 million ha with a productivity of 501 kg per hectare. Along the coastal belt of Andhra Pradesh, after *kharif* rice crop, blackgram is cultivated as relay crop under low input management without use of any additional inputs utilizing only the residual moisture and nutrients. The entire area under blackgram cultivation in Andhra Pradesh is 3.82 lakh hectares, with a production of 3.43 lakh tonnes and a productivity of 842.00 kg per hectare (Blackgram Outlook Report - January to May 2021 - ANGRAU).

With the onset of favourable conditions for both pest and disease, their simultaneous attack is leading to serious impact on the crop. So, to tackle this and to reduce the application costs, farmer tends to go for combined application of insecticides, fungicides along with the foliar nutrients but resulting in incompatibility and phytotoxic effects due to lack of knowledge pertaining to compatibility. To contain these effects, proper knowledge of compatibility and phytotoxicity on mixing plant protection chemicals must be established. Reckoning this fact, a laboratory experiment was conducted to test the physical compatibility and phytotoxicity of commonly used insecticides, fungicide and foliar nutrient on blackgram.

The laboratory experiment was conducted during 2022 at Department of Entomology, Agricultural College, Naira to test the physical compatibility of two commonly used biorational insecticides (novaluron 10 EC and spinosad 45 SC) with one fungicide (carbendazim 50 WP) and a foliar nutrient (19:19:19) which were further tested for phytotoxic symptoms on blackgram. The combinations used to test the physical compatibility are Novaluron 10 EC + Carbendazim 50 WP, Spinosad 45 SC + Carbendazim 50 WP, Novaluron 10 EC + Carbendazim 50 WP + 19-19-19 and Spinosad 45 SC + Carbendazim 50 WP + 19-19-19.

Glass jars of 1 litre capacity with lids were cleaned and filled upto half of their capacity *i.e.*, 500 ml (the same water that was used to fill the tank during pesticidal spray). The test combinations of insecticide or fungicide or foliar-nutrient (Novaluron 10 EC + Carbendazim 50 WP, Spinosad 45 SC + Carbendazim 50 WP, Novaluron 10 EC + Carbendazim 50 WP + 19-19-19 and Spinosad 45 SC + Carbendazim 50 WP + 19-19-19) at recommended dosage were added to the half filled jar, stirred immediately and the volume in the glass jar was made up to 1 litre. Mixing of test chemicals into the jar was made following the sequence: Wettable Powder, Wettable Granules, Soluble Concentrates (or) Emulsifiable Concentrates, Soluble Powder and

Soluble Liquid. Further, jars were closed tightly with caps, turned upside down for 10 times and kept aside undisturbed. Observations for physical incompatible phenomena like flakes, precipitate, gel, slurry *etc.*, were made twice at 30 and 60 minutes.

To test the phytotoxicity of insecticide, fungicide and foliar-nutrient combinations, blackgram (LBG - 787) seeds were sown in pots of 15 cm diameter, with plant to plant spacing of 10 cm thereby accommodating 3 plants in each pot. For each treatment 100 ml solution was prepared and 5 ml was sprayed uniformly on individual plant at 21 days after sowing (5 strokes per plant @ 1 ml per stroke). Observations for the specific parameters like leaf tips injury, surface injury, necrosis, wilting, vein clearing, hyponasty and epinasty were noted using phytotoxicity scale based on the grade prescribed by Central Insecticide Board and Registration Committee at 1 day before spraying and also on 1, 3, 5 and 7 days after spraying (CIB and RC, 2014). The per cent injury was calculated by using the formula:

Per cent injury =

$$\frac{\text{Total grade points}}{\text{Max.grade x No. of leaves observed}} \times 100$$

Physical compatibility test

Jar compatibility test was used to assess the physical compatibility status of two insecticides, one fungicide and one foliar-nutrient combinations in the present research work. The insecticidal and fungicidal combinations (novaluron + carbendazim and spinosad + carbendazim) did not show any incompatible phenomena (foam, precipitation, gel, slurry, flakes, layers *etc.*,) when observed after 30 and 60 minutes. On the other hand, foaming was observed after 30 (4.0 ml/l) and 60 (2.0 ml/l) minutes in the treatments involving foliar-nutrient (19:19:19) *i.e.*, novaluron + carbendazim+ 19:19:19 and spinosad + carbendazim + 19:19:19. However, foaming recorded in these treatments was less than the prescribed incompatible phenomena (20.0 ml/l or 2.0 ml/100 ml) which indicates that all the tested combinations were physically compatible and thus can further be tested for their phytotoxicity (Table 3. and Fig.1.).

The results were comparable to that of those obtained by Jayasekharan *et al*. (2018) where novaluron and spinosad were physically and chemically compatible with the fungicide carbendazim because neither lumps nor foaming was evident in the tested combinations. Madhuri *et al*. (2020) confirmed that novaluron was physically compatible with carbendazim. Rajasekhar and Mallapur (2017) reported that carbendazim in combination with insecticide spinetoram (descendant of spinosad) was unable to form sediments or creamy matter which indicates their compatibility with each other. Vidhyadhari *et al*. (2014) concluded that spinosad was physically compatible with fungicides (*viz.*, copperoxychloride, Metalaxyl MZ) and bactericide (streptocycline). Dileepa and Roopa (2021) proved that carbendazim in combination with commonly used foliar nutrient 19:19:19 was physically compatible with insectides such as thiamethoxam, flubendiamide, profenophos, chlorpyriphos, imidacloprid and chlorantraniliprole as neither foaming nor sedimentation was observed in combined mixture.

Phytotoxicity Test

All the tested combinations were physically compatible hence, they were subjected to phytotoxicity test by spraying on 21 days old blackgram plants. Observation for the development of any phytotoxic symptoms like leaf tip injury, surface injury, necrosis, wilting, vein clearing, hyponasty and epinasty were made as a part of pot culture studies. No phytotoxic symptoms were observed in any of the treatment which indicates their phytotoxic compatibility on blackgram. Therefore, it was

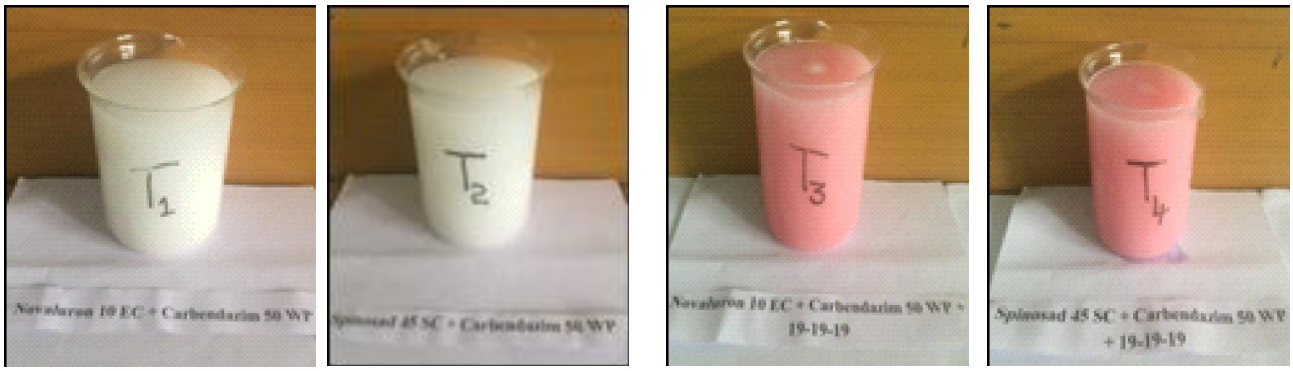

Fig 1. Jar compatibility Test

Table 1. Jar compatibility test of insecticides, fungicide and foliar-nutrient mixtures at various time intervals

Treatments	Foaming (ml/l)		Bottom sediment (ml/l)	
	30 min.	60 min.	30 min.	60 min.
T1	0	0	0	0
T2	0	0	0	0
T3	4	2	0	0
T4	4	2	0	0

Table 2. Per cent leaf injury values of insecticides, fungicide and foliar-nutrient combinations at recommended dose

Treatments	Recommended dose	Total Grade Points	Per cent leaf injury
T1	1.0 ml/l + 1.0 g/l	0	0
T2	0.4 ml/l + 1.0 g/l	0	0
T3	1.0 ml/l + 1.0 g/l + 10.0 g/l	0	0
T4	0.4 ml/l + 1.0 g/l + 10.0 g/l	0	0

Table 3. Compatibility Chart

	Carbendazim	Carbendazim + 19:19:19
Novaluron	Compatible and Non-phytotoxic	Compatible and Non-phytotoxic
Spinosad	Compatible and Non-phytotoxic	Compatible and Non-phytotoxic

concluded that all the experimented combinations were compatible both physically and phytotoxically on blackgram.

The results visualized in the present study were in concordance with that of those proved by Jayasekharan *et al*. (2018), who reported that insecticides *viz.*, emamectin benzoate, spinosad, novaluron and lufenuron showed no phytotoxic symptoms in combination with fungicides *viz.*, copper oxychloride, carbendazim, pyraclostrobin + metiram, metalaxyl + mancozeb, fenamidon + mancozeb and azoxystrobin when sprayed on tobacco plants. Similarly, Shaila and Rao (2014) proved that all the tested combinations of insecticides (abamectin,

emamectin benzoate, novaluron and lufenuron) and fungicides (mancozeb, carbendazim and chlorothalonil) when sprayed together did not showed any phytotoxicity symptoms on one and half month groundnut plants. Vidhyadhari *et al.* (2014) reported that spinosad, indoxacarb, cartap hydrochloride, chlorfenapyr, flubendiamide, *Bacillus thuringiensis* combined with 2 fungicides (copper oxychloride, metalaxyl MZ) and one bactericide (streptocycline) also did not show any phytotoxic symptoms on cabbage crop which is similar to the present work where spinosad has no incompatibility with other two components.

The outcome of carbendazim in the present study with respect to compatibility and phytotoxicity were in accordance with the studies made by Suganthy *et al.* (2010) where, no phytotoxic symptoms were observed when sprayed on bhendi, chilli and cotton crop mixed with imidacloprid. But, the results were not in line with study conducted on physical compatibility and phytotoxicity of insecticides mixed with fungicides on castor by Madhuri *et al.* (2020) where novaluron in combination with carbendazim showed phytotoxic symptoms *viz.*, vein clearing and scorching of leaves at 3 days after treatment.

CONCLUSION

Jar compatibility test revealed that the tested combinations *viz.*, novaluron + carbendazim, spinosad + carbendazim, novaluron + carbendazim + 19:19:19 and spinosad + carbendazim + 19:19:19 were observed to be physically compatible as they exhibited no signs of incompatible phenomenon like sedimentation, slurry, layering, precipitation, flocculation *etc.*, upon their combinations. Besides, all the tested combinations of pesticides and foliar nutrient were observed to be phytotoxically compatible on blackgram which was inferred as no phytotoxic symptoms were exhibited in any of the potted plants in all the replications. This vividly affirms that the test combinations do not pose any problem to the blackgram plants when treated against both insect and disease as all the tested combinations of insecticides and fungicides were compatible.

LITERATURE CITED

Agricultural Market Intelligence Centre 2021 *Blackgram outlook report – January to May, 2021*. Acharya N. G. Ranga Agricultural Univeristy, Lam, Guntur.

Central Insecticide Board and Registration Committee 2014 *Test protocol for bio-efficacy evaluation of pesticides*. Directorate of Plant Protection Quarantine and Storage, Faridabad.

Dileepa B N and Roopa S P 2021 Physical Compatibility of Chemicals used in Paddy Ecosystem. *Journal of Krishi Vigyan*. 10 (1): 213-217.

Jayasekharan B S, Sreedhar U and Rao G R 2018 Studies on compatibility of biorational insecticides with fungicides against tobacco caterpillar, *Spodoptera litura* Fabricius on tobacco. *Indian Journal of Plant Protection*. 46 (2-4): 107-112.

Madhuri G, Duraimuragan P, Divyarani V, Nalini N, Durgarani Ch V, Sadaiah K, Ramana M V and Anuradha G 2020 Physical compatibility of insecticides and fungicides and their phytotoxicity on castor. *Journal of Oilseeds Reseach*. 37: 241-242.

Rajasekar B and Mallapur C P 2017 Physical compatibility of agro-chemicals in laboratory. *Journal of Pharmacognosy and Phytochemistry*. 6 (3): 273-275.

Shaila O and Rao S R K 2014 Physical and phytotoxic compatibility of avermectins and

chitin synthesis inhibitors with common fungicides. *Pollution Research*. 33 (1): 41-44.

Suganthy M, Kuttalam S and Chandrasekaran S 2010 Compatibility of Confidence® (imidacloprid 17.8% SL) with some chemical and botanical pesticides on cotton, bhendi and chilli. *Madras Agricultural Journal.* 97 (1-3): 73-74.

Vidhyadhari V, Sridevi G, Pushpavathi B and Rameshbabu T 2014 Physical and phytotoxic compatibility of insecticides and fungicides/bactericide on cabbage. *Society for Scientific Development in Agriculture and Technology.* 9: 1155-1158.

Department of Entomology, Agricultural College, Naira, A.P.

K Sunil Varma,
D Anil Kumar,
S Dhurua and
S Ramesh Babu