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Compatibility of Bio Efficacy of Agrochemicals Used in Sunflower

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ABSTRACT

Five commonly used insecticides (contact and systemic), two fungicides and one micronutrient in twenty nine combinations were tested for its physical, chemical compatibility, phytotoxicity and bio efficacy on sunflower crop at Regional Agricultural Research Station, Nandyal during rabi, 2013-14. All the agro chemicals tested were physically and chemically compatible. Among the 29 combinations, phytotoxicity symptoms were observed in imidacloprid 17.8 % SL + triazophos 40%EC ; imidacloprid 17.8 % SL + monocrotophos 36%SL ; imidacloprid 17.8 % SL + flubendiamide 480 SC; triazophos 40%EC + (carbandazim + mancozeb); and triazophos + wettable sulphur with a scale of 6,7,1,1 and 1, respectively. The bio efficacy studies revealed that among all the treatments, triazophos 40% EC+ monocrotophos 36 % SL (90.8%) , monocrotophos 36 %SL + flubendiamide 480 SC (58.9%) and rynaxypyr 20 SC + wettable sulphur (62.0%) have registered highest per cent reduction of jassids, whiteflies and leaf damage due to lepidopteran pest complex, respectively over control. Further, the combination of triazophos 40 EC + rynaxypyr 20 SC was effective against jassids and lepidopteran pests and also recorded higher yield (1931 kg/ha).

Key words: *Sunflower, Carbandazim, Mancozeb, Triazophos, Lepidopteran.*

INTRODUCTION

Sunflower is a promising oilseed crop next to groundnut and soybean in India, which is attacked by nearly 250 sp of insects throughout the world. The numbers of chemicals involved in plant protection are too many and the information on compatibility of individual chemical is scanty. Common growers facing difficulty in ascertaining the compatibility of agro-chemicals. Hence, based on experience, Gray[2] prepared a chart showing compatibility of some insecticides and fungicides. Later several charts were developed or updated by Frear[1], Gruzdyed *et al.*[3], for the chemicals in use with additional information regarding compatibility in different crops, season, aging of mixtures and many other factors. Later, Baicu suggested studying compatibility in different stages including determination of chemicals and physical properties, biological activity of compounds, field tests for effectiveness, phytotoxcity and yield after treatment.

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Sunflower crop is attacked by both sucking and lepidopteran pests for which farmers are using both contact and systemic insecticides as tank mixtures and simultaneously to manage both the pest especially at vegetative stage and bud initiation stage leading to problems like resistance and phytotoxicity. Keeping these problems in view five commonly used insecticides (contact and systemic), two fungicides and one micronutrient individually and in combinations were tested for their physical and chemical compatibility and bio efficacy on sunflower crop at Regional Agricultural Research Station, Nandyal during *rabi*, 2013-14.

MATERIALS AND METHODS

The experiment was conducted at Regional agricultural Research Station, Nandyal in *rabi*, 2013-14, sunflower hybrid N K Armoni was used as test hybrid and the crop was raised following all the recommended package of practices except plant protection. Agrochemicals (5 insecticides, *viz*., imidacloprid 17.8%SL, triazophos 40 EC, monocrotophos 36 SL, rynaxaypyr 20 SC and flubendiamide 480 SC ; two fungicides v*iz*., (carbendazim25 WP + mancozeb 25 WP) and wettable Sulphur, one foliar micro nutrient *i.e* boron) were tested at recommended doses arrived at 29 combinations which were tested for their physical and chemical compatibility following standard procedures**.** For testing physical compatibility, clear glass jars with lids (250 ml capacity) were taken with 100 ml water and to this added the test insecticides/ fungicides (undiluted chemical as per dilution factor) in the order of WP-WG-SC-SP- SL. The mixtures were stirred after each addition and capped the jars tightly with lids and turn the jars 10 times and left aside for 5 Minutes. Finally observed for incompatible phenomena (flakes/precipitate/gel/slurry/layering, etc.). Among the combinations, physically compatible combinations were tested for their phytotoxicity at field level at flowering stage of the crop and recorded the phytotoxicity score using 0-9 scale.

Phytotoxicity scale

Observations on phytotoxity were recorded at a day before , 3,7 and 15 days after spray. Observation for the specific parameters like leaf tip & surface injury, hyponasty and epinasty and scorching were recorded by using following scale.

Phytotoxicity rating scale (PRS)

S. NO	Crop Response / Crop injury	Rating
1	0-00	0
2	1-10 %	1
3	11-20%	2
4	21-30%	3
5	31-40%	4
6	41-50%	5
7	51-60%	6
8	61-70%	7
9	71-80%	8
10	81-90%	9
11	91-100%	10

Safe combinations with zero phytotoxicity ratings were studied for bio-efficacy against the pests of sunflower (Jassids, whiteflies and lepidopteran pest complex). Observations on the incidence of jassids, whiteflies and leaf damage (due to *Spodoptera litura* and

*Trio**choplusia ni***) were recorded on five randomly selected and tagged plants and expressed in terms of number per three leaves for sucking pest and percent leaf damage for lepidopteran pest complex. Observations were recorded at a day before (pre treatment) and 5 days after the imposition of treatments.

RESULTS AND DISCUSSION

All the treatment combinations were tested for their physical and chemical compatibility under lab conditions and were found compatible both physically and chemically. Out of 29 combinations, five combinations *i.e* imidacloprid 17.8 % SL + triazophos 40%EC , imidacloprid 17.8 % SL + monocrotophos 36%SL , imidacloprid 17.8 % SL + flubendiamide 480SC , triazophos 40%EC + (carbandazim + mancozeb) and triazophos + wettable sulphur recorded the phytotoxicity symptoms on leaves with a scale of 6,7,1,1 and 1, respectively (Table 1 & 2) .

The remaining combinations (24 treatments) were evaluated for bio-efficacy against jassids, whiteflies and lepidopteran pests. Among all the treatments, per cent reduction over control (ROC) in relation to jassids was highest in triazophos 40% EC + monocrotophos 36 % SL (90.8%) and was on par with monocrotophos 36 % SL + (carbendazim 25 WP + mancozeb 25 WP) 81.7%. The combinations *viz.*, monocrotophos 36 % SL + flubendiamide 480 SC ,monocrotophos 36 SL + wetable sulphur and imidacloprid 17.8 SL + rynaxypyr 20 SC were the best against white fly with 58.9, 56.2 and 54.4 per cent reduction over control, respectively. Per cent reduction over control of leaf damage (due to lepidopteran pest complex) was high in rynaxypyr 20 SC + wettable sulphur (62.0%), rynaxypyr 20 SC alone (56.2 %), rynaxypyr 20 SC + imidacloprid 17.8 SL (55.8 %) and rynaxypyr 20 SC + triazophos 40 EC (55.6 %), indicating rynaxypyr 20 EC was effective against lepidopteran pest complex as single insecticide and also in combinations with systemic insecticides like imidacloprid and triazophos which are effective against sucking pest of sunflower and with fungicides wettable sulphur recommended against powdery mildew of sunflower. The efficacy of rynaxypyr (chlorantranalliprole) against lepidopteran was in agreement with Siddarth *et a.,l* 2014, who reported that chlorantraniliprole in combination with carbandazim + mancozeb showed synergistic effect, whereas indoxcarb with (carbandazim +mancozeb) were antagonistic against *Plutella xylostella* larvae. However, the highest seed yield (1921 kg per hectare) was recorded with triazophos 40 EC + rynaxypyr 20 SC combination followed by monocrotophos 36 SL+ (carbendazim25 WP + mancozeb 25 WP) (1830 kg/ha.).

Table 1: Compatibility chart for Insecticides Vs Fungicides Vs fertilizers

	AGRO CHEMICALS	**Imidacloprid**	**Triazophos**	**Monochrotophos**	**Rynaxaypyr**	**Flubendiamide**	**Carbondazim + Mancozeb**	**wettablesulphur**	**Boron**
1	Imidacloprid 17.8%SL	-	**X (6)**	**X (7)**	C	**X (1)**	C	C	C
2	Triazophos 40 EC		-	C	C	C	**X (1)**	**X (1)**	C
3	Monocrotophos 36 SL			-	C	C	C	C	C
4	Rynaxaypyr 20 SC				-	C	C	C	C
5	Flubendiamide 480 SC					-	C	C	C
6	Carbendazim25 WP + Mancozeb 25 WP						-	C	C
7	WettableSulphur							-	C
8	Boron								-

*Numbers in parenthesis are Phytotoxity score

X- Not Compatible C- Compatible

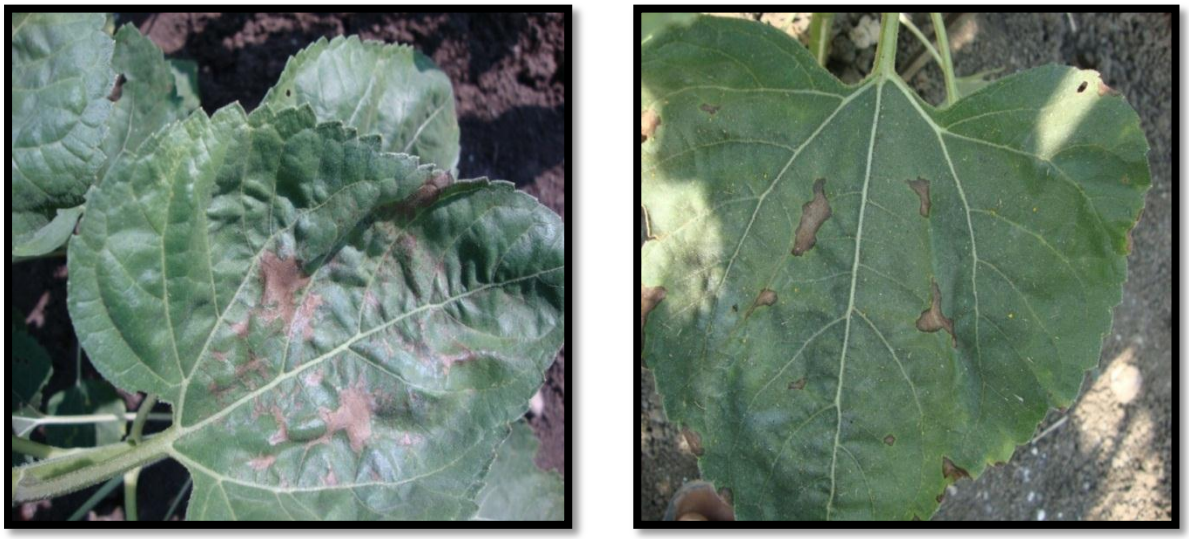
Table 2: Combinations of insecticides, fungicides and fertilizers used on sunflower for their phytotoxicity studies

S. No	Tr. No.	Treatment combination	Leaf epinasty	Leaf hyponasty	Necrosis	Scorching
1	T1	Imidacloprid +Triazophos	Not found	Not found	Not found	**Found**
2	T2	Imidacloprid + Monocrotophos	Not found	Not found	Not found	**Found**
3	T3	Imidacloprid + Rynaxypyr	Not found	Not found	Not found	Not found
4	T4	Imidacloprid +Flubendiamide	Not found	Not found	Not found	**Found**
5	T5	Imidacloprid +(carbandazim +mancozeb)	Not found	Not found	Not found	Not found
6	T6	Imidacloprid +Sulphur	Not found	Not found	Not found	Not found
7	T7	Imidacloprid	Not found	Not found	Not found	Not found
8	T8	Triazophos + Monocrotophos	Not found	Not found	Not found	Not found
9	T9	Triazophos + Rynaxypyr	Not found	Not found	Not found	Not found
10	T10	Triazophos + Flubendiamide	Not found	Not found	Not found	Not found
11	T11	Triazophos + (carbandazim +mancozeb)	Not found	Not found	Not found	**Found**
12	T12	Triazophos + wettable sulphur	Not found	Not found	Not found	**Found**
13	T13	Triazophos	Not found	Not found	Not found	Not found
14	T14	Monocrotophos + Rynaxypyr	Not found	Not found	Not found	Not found
15	T15	Monocrotophos + Flubendiamide	Not found	Not found	Not found	Not found
16	T16	Monocrotophos +(carbandazim +mancozeb)	Not found	Not found	Not found	Not found
17	T17	Monocrotophos +Sulphur	Not found	Not found	Not found	Not found
18	T18	Monocrotophos	Not found	Not found	Not found	Not found
19	T19	Rynaxypyr+ Flubendiamide	Not found	Not found	Not found	Not found
20	T20	Rynaxypyr +(carbandazim +mancozeb)	Not found	Not found	Not found	Not found
21	T21	Rynaxypyr +Sulphur	Not found	Not found	Not found	Not found
22	T22	Rynaxypyr	Not found	Not found	Not found	Not found
23	T23	Flubendiamide +(carbandazim +mancozeb)	Not found	Not found	Not found	Not found
24	T24	Flubendiamide +Sulphur	Not found	Not found	Not found	Not found
25	T25	Flubendiamide	Not found	Not found	Not found	Not found
26	T26	(carbandazim +mancozeb)+Sulphur	Not found	Not found	Not found	Not found
27	T27	(carbandazim +mancozeb)	Not found	Not found	Not found	Not found
28	T28	Sulphur	Not found	Not found	Not found	Not found
29	T29	Control (Water spray)	Not found	Not found	Not found	Not found

Table 3: Bio efficacy studies of compatible combinations in relation to jassids, whiteflies and lepidopteran pests

S.No	Treatment	Jassids / 3 leaves			White flies/3 leaves			Leaf damage % (Lep. Pest)			Yield (Kg/ha)
		Pre tre.	5 DAT.	%ROC	Pre treatment	5 DAT	% ROC	Pre treatment	5 DAT	% ROC	
1	Imidacloprid + Rynaxypyr	6.6	4.3	62.7	3.7	3	54.4	47.8	28.6	55.8	1250
2	Imidacloprid +(carbandazim +mancozeb)	5.2	4.2	53.8	4.9	5	42.7	49.0	34.8	47.6	1241
3	I+Sulphur+B	8.7	6.1	59.9	4.3	4.7	38.6	44.0	42.8	28.2	1623
4	Imidacloprid +Sulphur	6.2	4.7	56.6	3.3	5.2	11.5	37.2	40.2	20.3	1538
5	Imidacloprid	5.6	0.9	90.8	5.6	5.3	46.8	49.9	38.5	43.0	1496
6	Triazophos + Monocrotophos	8.2	3.5	79.6	4.4	5	36.2	40.8	25.6	55.6	1921
7	Triazophos + Rynaxypyr	6.0	3.45	67.1	4.8	4.9	42.6	46.5	46.1	26.7	1523
8	Triazophos + (carbandazim +mancozeb)	7.0	5.5	55.1	6.4	6.9	39.4	42.9	32.2	44.6	1645
9	Triazophos + wettable sulphur	8.8	3.7	76.0	3.8	4.6	32.0	45.2	38.5	37.2	1211
10	Triazophos	6.6	3.3	71.4	5.6	4.1	58.9	59.1	46.2	42.2	1434
11	Monocrotophos + Rynaxypyr	10	3.2	81.7	4.8	4.3	49.7	52.1	39.1	44.5	1830
12	Monocrotophos + Flubendiamide	6.55	2.6	77.3	5.9	4.6	56.2	63.6	54.3	37.0	707
13	Monocrotophos +(carbandazim +mancozeb)	8.7	5.8	61.9	4.6	6	26.7	47.6	34.1	47.1	1813
14	Monocrotophos +Sulphur	6.3	5.2	52.8	4.1	6.7	8.2	46.4	26.7	57.4	1146
15	Rynaxypyr +(carbandazim +mancozeb)	8.8	5.7	63.0	5.7	4.5	45.5	38.5	24.8	52.5	1293
16	Rynaxypyr +Sulphur	4.9	4.7	45.1	6.0	5.1	42.2	48.6	25.0	62.0	1100
17	Rynaxypyr	6.4	8.1	27.6	6.7	6.6	44.7	36.4	21.6	56.2	1488
18	Flubendiamide +(carbandazim +mancozeb)	5.7	6.1	38.8	7.3	6.6	49.2	47.1	49.9	21.6	1304
19	Flubendiamide +Sulphur	6.3	7.7	30.1	5.7	5.6	44.8	37.9	47.3	7.7	1404
20	Flubendiamide	8.6	7.2	52.1	7.4	6.6	49.9	54.3	40.5	45.0	1414
21	(carbandazim +mancozeb)+Sulphur	7.0	7.2	41.2	8.0	5.8	49.3	48.7	61.6	6.6	1445
22	(carbandazim +mancozeb)	9.0	7.9	49.8	8.4	6.6	52.9	49.7	52.7	21.8	1480
23	Sulphur	10.4	7.6	58.2	7.4	6.2	52.9	44.6	45.3	25.0	996
24	Control (Water spray)	7.95	13.9	0.0	5.0	8.9	0.0	38.0	51.5	0.0	648.0
	F Test	NS	S	S	S	S	S	NS	S	S	S
	Sem	0.22	0.17	3.67	0.22	0.19	1.87		3.89	2.12	179.2
	CD @ 0.05	0.63	0.50	11.01	0.65	0.55	5.63		11.26	6.45	519.2
	CV %	7.59	6.92	16.61	8.64	8.00	14.47		9.40	12.6	13.4

Imidacloprid + monocrotophos +boron



Flubendiamide + imidacloprid +boron

Phytotoxicity symptoms on sunflower crop

CONCLUSION

Among 29 combinations tested on sunflower, all the combinations were physically as well as chemically compatible except a few,which exhibited the phytotoxicity at the field level. In bio efficacy studies of all compatible agrochemical combinations in sunflower indicated that , the combinations of triazophos 40 EC + rynaxypyr 20 SC along with boron was effective against both jassids and lepidopteran pests and also recorded the higher yields.

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