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Bioefficacy of commercial adjuvants against some plant pathogens

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The experiment was conducted to know the efficacy of four commercial adjuvants viz. APSA-80, TIPTOP, HASTEN and VELVET at four different concentrations (0.01, 0.02, 0.04 & 0.08%) against three pathogens (*Pythium, Helminthosporium* and *Macrophomina*).Laboratory studies showed that, among four adjuvants APSA-80 was better active against *Pythium* (63.88% & 56.38% inhibition at higher and lower doses of concentration respectively) and *Macrophomina* (63.05% & 51.38% inhibition at higher and lower doses of concentration respectively) than other adjuvants. But TIPTOP showed highest inhibitory per cent (68.88% & 63.05%) and HASTEN showed lowest inhibitory per cent (60.00%&42.50%) at both higher and lower doses of concentrations against *Helminthosporium oryzae*,and APSA-80 showed more or less good result (65.55% & 45.00% inhibition at higher and lower concentration respectively). Field studies of APSA-80 with Mancozeb 75 WP, Copper oxychloride 50WP and Chlorothalonil 75WP on potato showed better result when APSA-80 sprayed @ 2.3 ml/10 lit. than @ 3.3 ml/10 lit. as sole or in combination with fungicides at their recommended dose. When APSA-80 sprayed @ 3.3 ml /10 lit of water along with these fungicides or sole showed mild phytotoxicity on the potato leaves in the form of marginal chlorosis. The increase in tuber yield was highest (40.4%) in the combination of Mancozeb 75WP @ 25g + APSA-80 @ 2.3 ml/10 lit. of water followed by Copper oxychloride 50WP (39.5%) and Chlorothalonil 75WP (35.6%).

Key words: Adjuvants, bioefficacy, APSA-80, phytotoxicity, potato.

INTRODUCTION

Adjuvant, the additive material broadly includes wetter-spreaders, stickers, penetrants etc. are commonly mixed with pesticides during spray to improve the effectiveness and performance of the spray materials (Anonymous, 1989) i.e. coverage (Steurbaut, 1993), retention (Hart *et al.*, 1992, Reddy and Locke, 1996), translocation (Maschoff *et al.,* 2000) and efficacy (Grayson *et al.,* 1996).To reduce the pesticide waste now it is obligatory to mix an adjuvant with spray mixes specially when sprayed on crops having glossy phylloplane but can be applied on almost all types of crop plants like paddy, wheat, potato,, vegetables etc.In view of benefit-cost ratio application of an adjuvant with pesticide is very effective and useful because fungicide application without an adjuvant required 16 times more product to achieve 90% therapeutic control (David *et al.,* 2003) and may improve disease managements. Though the adjuvant improves the spray performance of pesticides but the knowledge about the efficacy of adjuvants is very meagre till date. In this respect this study has been done to know the efficacy of some commercial adjuvant against few plant pathogens.

MATERIALS AND METHODS

The present investigation was carried out at laboratory (Department of Plant Pathology) and as well as at Instructional farm of BCKV, West Bengal.

Laboratory studies

For *in vitro* experiment, there were four adjuvants and three pathogens. The test pathogens were isolated by surface sterilization & tissue segment method (Rangaswami, 1958) on potato dextrose agar medium. The cultures were purified by hyphal tip culture method (Rangaswami, 1958). The efficacy of four commercial adjuvants viz. APSA-80, TIPTOP,

HASTEN and VELVET were tested at four different concentrations (0.01, 0.02, 0.04 & 0.08%) against three pathogens (*Pythium, Helminthosporium* and *Macrophomina*) by using poisoned food technique (Schmitz, 1930). The concentration of poisoned food was obtained by adding required amount of adjuvant with the help of micropipettes in 100 ml of sterilized & melted PDA. This 100 ml of melted PDA-adjuvant mixture was plated in 5 Petri-plates and allow to solidify. The solidified Petri-plates then inoculated with 6·mm disc of 7 days old culture of test pathogens. Medium without adjuvant were served as control. The Petri-plates were incubated at 28 ±1 °C.The observation on colony diameter was recorded when the check Petri-plates were fully covered with the growth of the test pathogen. The radial growth was measured and inhibition percentage was calculated by using the following formula:

$$I = \frac{C - T}{C} \times 100$$

Where, I = Inhibition percentage
C= Colony diameter in check (mm)
T= Colony diameter in treatments (mm)

Field studies

The field experiment in a randomize block design was conducted during *Rabi* season (2006-07) on potato c.v. Kufri Chandramukhi after *in vitro* bioefficacy of adjuvants with some pathogen isolates. For field experiment there were 12 treatments and three replications with plot size 12 m^2. Among the four adjuvants considerably best one was selected for field performance with some foliar fungicides. Planting of potato was done at spacing with 45 cm x 15 cm. Three sprays were given commencing from the first appearance of the disease symptoms on foliage at 10 days interval. Data were recorded on percentage of leaf damage (per cent disease) on 0 — 4 scale by visual observations. Application of fertilizers at recommended doses and interculture operations were done as and when required. Tuber yield were recorded at harvest of the crop.

RESULTS AND DISCUSSIONS

In vitro efficacy

A reduction of growth of colony diameter was found in each treatment of four adjuvants against all three pathogenic isolates; reading was taken at 8th day when the control was fully covered with pathogenic mycelium. It was observed that the colony diameters of pathogens were decreased with increasing the concentrations of each adjuvant i.e.inhibition per cent was increased gradually at higher concentrations. It is appeared from the result (Table 1.) that, among four adjuvants APSA-80 showed better inhibitory effect against *Pythium* (63.88% & 56.38% at higher and lower doses of concentration respectively) and *Macrophomina* (63.05% & 51.38% at higher and lower doses of concentration respectively) than other adjuvants. But all the four adjuvants showed more or less similar inhibitory effect against *Helminthosporium oryzae* where TIPTOP showed highest inhibitory percent (68.88% & 63.05%) and HASTEN showed lowest inhibitory per cent (60.00% & 42.50%) at higher and lower doses of concentrations. APSA-80 showed more or less good result (65.55% & 45.00% inhibition at higher and lower concentration respectively) against *Helminthosporium oryzae*.So, considering the above inhibitory activities APSA-80 may be considered as a better adjuvant among the four.

In vivo efficacy

As the APSA-80 was considered as better adjuvant among the four so field trial was conducted with APSA-80. It is appeared from the result (Table 2.) that, the APSA-80 @ 2.3 ml/10 lit. of water irrespective of fungicide viz., Mancozeb75WP (Indofil M-45@ 25 g/10 lit. of water), Copper oxychloride 50WP (Blitox-50 @ 40 g /10 lit. of water) and Chlorothalonil 75WP (Kavach @15 g/10 lit. of water) with three sprays at 10 days interval had no phytotoxic effect. On the other hand they reduced the per cent disease severity over control either alone or in combination with APSA-80 @ 2.3 ml/10 lit of water and increased the tuber yield. While APSA-80 sprays @ 3.3 ml /10 lit of water along with these fungicides showed mild phytotoxicity on the potato leaves in the form of marginal chlorosis. The tuber yield was significantly increased, 40.4% in case of Mancozeb 75WP @ 25 g + APSA-80 @ 2.3 ml/10 lit of water to 39.5% in case of Copper oxychloride 50WP @ 40 g + APSA-80 @2.3 ml/10 lit. of water, while the effect of Chlorothalonil 75WP + APSA-80 was lower (35.6%) among the three fungicides used. Mild phytotoxic effect such as chlorotic leaf tip and margins also found at higher dose (3.3ml/10 lit) of APSA-80 either alone or in combina-

Table 1 :. In vitro bioefficacy of some commercial adjuvants against some pathogens.

Adjuvants*	Concentration (%)	*Pythium* sp.		*Helminthosporium oryzae*		*Macrophomina phaseolina*	
		Colony diameter (mm)**	Inhibition (%)	Colony diameter (mm)	Inhibition (%)	Colony diameter (mm)	Inhibition (%)
APSA-80	0.01	39.25	56.38	49.50	45.00	43.75	51.38
	0.02	38.25	57.50	44.50	50.55	39.00	56.66
	0.04	35.00	61.11	41.00	54.44	35.25	60.83
	0.08	32.50	**63.88**	31.00	**65.55**	33.25	**63.05**
TIPTOP	0.01	55.00	38.88	33.25	63.05	55.75	38.05
	0.02	50.50	43.88	33.00	63.33	49.25	45.27
	0.04	44.25	50.83	29.25	67.50	38.25	57.50
	0.08	38.00	**57.77**	28.00	**68.88**	36.00	**60.00**
HASTEN	0.01	56.75	36.94	51.75	42.50	54.75	39.16
	0.02	55.50	38.33	45.00	50.00	54.00	40.00
	0.04	53.75	40.27	40.75	54.72	47.75	46.94
	0.08	49.00	**45.55**	36.00	**60.00**	37.75	**58.05**
VELVET	0.01	45.75	49.16	35.75	60.27	45.00	50.00
	0.02	40.25	55.27	35.00	61.11	38.50	57.22
	0.04	35.75	60.27	34.25	61.94	37.00	58.88
	0.08	34.25	**61.94**	28.50	**68.33**	35.25	**60.83**
Control		90.00	0.0	90.00	0.0	90.00	0.0
CD (*P*=0.05)Adjuvant		0.70831		0.66226		0.74018	
CD(*P*=0.05)Concentration		0.79192		0.74043		0.82755	
CD(*P*=0.05) Interactions (A x C)		1.58383		1.48085		1.65510	

[*APSA-80 - (Nonionic Surfactant) Alkylaryl alkoxylate of Amway India Enterprises ; *HASTEN -commercial adjuvant of Victorian Chemical Company, Australia ; *TIPTOP -commercial adjuvant of Krishi Rasayan Company, India ; *VELVET -commercial adjuvant of Sudarsan Chemical Company, India.] ; **The values are the average of five replications.

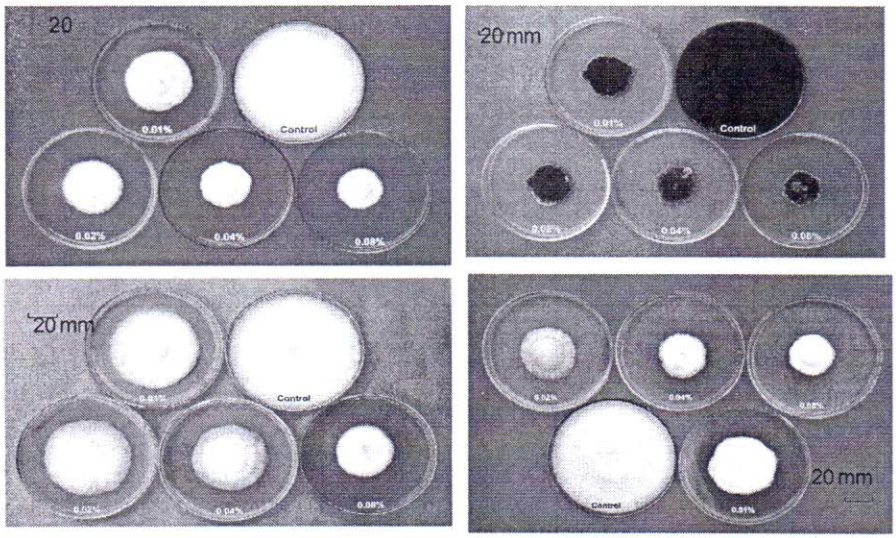

Fig. 1 : Interaction between- 1. APSA-80 and *Pythium* sp. 2. APSA-80 and *Helminthosporium oryzae*. 3. HASTEN and *Pythium* sp 4. VELVET and *Pythium* sp.

Table 2 : Bioefficacy of APSA-80 with some fungicides against foliar diseases of potato:

Treatments Chemicals 10lit.of solution)	% decrease in Late blight over control	% decrease in Early blight over control	% decrease in Cercospora leaf spot over control	Tuber yield (q/ha)	% increase in yield	Phytotoxic effect
Copper oxychloride 50WP @40 g	73.7	73.9	69.3	218.4	28.4	(-)
Copper oxychloride 50WP @ 40 g + APSA-80 @3.3ml	68.5	68.1	59.6	215.1	26.5	(+), Mild
Copper oxychloride 50WP @ 40 g + APSA-80 @2.3ml	83.3	89.1	75.1	237.2	39.5	(-)
Chlorothalonil 75WP @ 15g	75.8	70.8	68.1	209.8	23.5	(-)
Chlorothalonil 75WP @ 15g + APSA - 80 @3.3ml	72.5	65.4	60.6	205.4	20.8	(+), Mild
Chlorothalonil 75WP @ 15g + APSA - 80 @2.3ml	80.6	77.0	74.2	230.5	35.6	(-)
Mancozeb 75 WP @25g	77.3	72.8	67.6	219.8	29.3	(-)
Mancozeb 75 WP @25g + APSA -80 @3.3ml	73.5	64.2	55.4	216.0	27.0	(+), Mild
Mancozeb 75 WP @25g + APSA -80 @2.3ml	84.6	77.4	73.7	238.7	40.4	(-)
APSA-80 @3.3ml	-0.3	-0.02	-3.2	165.0	-2.9	(+), Mild
APSA-80 @2.3ml	0.0	0.0	0.5	170.0	0.0	(-)
Control (Water spray)	0.0	0.0	0.0	170.0	0.0	(-)
CD (*P*=0.05)	-	-	-	1.995	-	-

tion with fungicides. Thus adjuvants have very effective and useful role in disease management as well as spray performance of fungicides.

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