DIRECTORATE OF RESEARCH SERVICES
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2nd Floor, Administrative Block, Raja Pancham Singh Marg, Gwalior 474 002 M.P.
(An ISO 9001:2008 Certified Organization No. 67934/A/0001/UK/En)

Dr. S.K. Sharma
Director Research Services

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No. DRS/CPC/2022/ 2991

Date: 23-12-2022

SPEED POST

To,

M/s. Isha Agro India,
Office No. 05, B 101, Malati Complex,
4/129, Ideal Colony, Paud Road, Kothrud,
Puna – 411038
(Mob. No. – 09372618677)

Subject: Submission of technical report –reg.

Please find enclosed herewith the test report on "Evaluation of bio-efficacy trial of research product PSAP– Potassium Salt of Active Phosphorous on Opium Poppy (Papaver somniferum) during Rabi 2021-22". The experiment was conducted at College of Horticulture, Mandsaur. It is for your kind information and further necessary action.

Encl.: As above.

23/12/2022

Director Research Services

End. No. DRS/CPC Report/2022/ Date:

CC for information and necessary action to:

1. The Dean, College of Horticulture, Mandsaur.
2. Person concerned Dr. R.S. Chundawat, Principal Scientist, College of Horticulture, Mandsaur.
3. The P.S. to Hon'ble Vice Chancellor, RVSKVV, Gwalior.

Sd/-

Director Research Services

A RESEARCH REPORT ON

EVALUATION OF BIOEFFICACY TRIAL OF RESEARCH PRODUCT PSAP- POTASSIUM SALT OF ACTIVE PHOSPHORUS ON OPIUM POPPY (*Papaver somniferum*)

FOR THE YEAR
2021-22
(IIIrd Season)

Sponsored by:
Isha Agro India Paud Road
Kothrud, Pune 411038

Submitted by

B. K. Patidar
Assistant Professor (Pl. Pathology)

Dr. R. S. Chundawat (PI)
Pr. ScientistAICRP M&AP

COLLEGE OF HORTICULTURE MANDSAUR,
RAJMATA VIJAYARAJE SCINDIA KRISHI VISHWA VIDYALAYA
GWALIOR- (M.P)

Evaluation of bio-efficacy trial of research product PSAP- Potassium salt of active Phosphorus on Opium Poppy (*Papaver somniferum*)

1.	**Name of the Trial**	:	Evaluation of bio-efficacy trial of research product PSAP- Potassium salt of active Phosphorus on Opium Poppy (*Papaver somniferum*)
2.	**Name and Address of Sponsorer and Letter No & Date**	:	Prashant P. Nandargikar Isha Agro India Off No. 05, B 101, Malati Complex, 4/129, Ideal Colony, Paud road,Kothrud, Pune 411038
3.	**Name of Manufacturer of Product**	:	Isha Agro India Off No. 05, B 101, Malati Complex, 4/129, Ideal Colony, Paud road,Kothrud, Pune 411038
4.	**Name of the investigators**	:	1. Dr. R.S. Chundawat (PI) Pr. Scientist AICRP M&AP 2. B. K. Patidar (Co-PI) Assistant Professor(Plant Pathology) College of Horticulture Mandsaur (M.P.) 458 002

5.General Information		
a. Location	:	AICRP M&AP Research Field, College of Horticulture Mandsaur (M.P.) 458 002
b. Season	:	*Rabi* 2021-22
c. Year	:	2021-22(IInd season)
d. Crop	:	Opium Poppy
e. Variety	:	JA-16
f. Soil Type	:	Clay Loam Soil
g. Irrigated / Rainfed	:	Irrigated
h. Meteorological Observations during the crop period	:	Enclosed

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6. Experimental Details			
a. Design	:	Randomized Block Design	
b. No of treatments:	:	6	
c. No of replications	:	3	
d. Plot size	:	3 m x 2.1 m	
e. Spacing	:	0.30 m x 0.1 m	
f. Date of sowing	:	10/11/2021	
h. Date of PSAP applications		1st Spray	10/12/2021
		2nd Spray	25/01/2021
		3rd spray	15/01/2022
		4th spray	05/02/2022

7. Treatment Details for Bio efficacy			
Sl. No.	**Treatment**	**Dosage (g/ litre)**	**Water volume (l/ha)**
T_1	Recommended Spray Scheduled for crop without PSAP- Control	-	500
T_{12}	T_1 + with foliar sprays of PSAP @ 4g/litre	4g/litre	500
T_{13}	T_1 + with foliar sprays of PSAP @ 6g/litre	6 g/litre	500
T_2	50 % reduction in recommended plant protection sprays (No. of Sprays) without PSAP.	-	500
T_{21}	T2 + with Foliar Sprays of PSAP @ 4g/litre	4g/litre	500
T_{22}	T2 + with Foliar Sprays of PSAP @ 6g/litre	6 g/litre	
For Phytotoxicity			
T_1	PSAP @ 8g/litre at 35 DAS	8 g/litre	500
T_2	PSAP @ 12g/litre at 35 DAS	12 g/litre	500

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8. Observations recorded:

1. Plant Height (cm)
2. Weight of Latex, Husk, Seeds per 10 AR and hectare
3. Disease intensity PDI of Downy mildew and Powdery mildew
4. Phytotoxicity on opium plant

9. Methodology:

The field trial was conducted during Rabi 2021-22 at AICRP M&AP Research Field,College of Horticulture, Mandsaur (M.P) to evaluate the PSAP- Potassium salt of Active Phosphorus against Downy mildew(*Peronospora arborences*) and Powdery mildew (*Erysiphe polygoni*) of opium poppy.

All the standard agronomic practices were followed as per the recommendations of the for Cultivation of opium poppy. The evaluation of the test chemical was done along with checks against the incidence of Downy Mildew and Powdery Mildew of Opium poppy. First foliar spray of test product was done just on the onset of disease symptoms followed by another spray which was given inrecommended scheduled describe in cultivation package.

9.1 Bio efficacy:

The disease rating was done based on the following rating scale.

Disease rating scale-

Disease rating	Infection on opium leaf
0	No visible symptoms appared
1	1- 5% infection
2	6-10% infection
3	11-25% infection
4	26-50% infection
5	More than 50 % infection

A Percent disease index (PDI) was calculated according to the following:

$$\text{PDI} = \frac{\text{Sum of all disease ratings}}{\text{Total no of plants assessed x Maximum Disease rating}} \times 100$$

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The data of the per cent disease index was recorded in each treatment and replication wise and transformed to arcsine values before statistical analysis. The observations were recorded before each spray and 10 days after final spray. Randomly 5 selected plants per treatment /replication and were assessed for scoring the incidence of diseases. The assessment of disease of Downy and Powdery mildew of opium poppy was performed by calculating the score into percent disease index (PDI).

Latex yield, seed yield, husk yield and morphine content (%) was recorded in kg per plot at harvest in each treatment and converted into quintal per hectare.All the data with respect to disease incidence and yield was statistically analyzed using Analysis of Variance (ANOVA) and results were interpreted to work out optimum dose of the test chemicals.

9.2. Phytotoxicity

To evaluate the phytotoxicity of PSAP- Potassium Salt of Active Phosphorus, parameters like chlorosis, necrosis, wilting, scorching, hyponasty and epinasty were recorded at 0, 1st, 3rd, 5th, 7th and 10thdays after first application using mentioned rating scale.

10 Experimental Results:

In order to test the efficacy of combination of PSAP with systemic fungicides against downy mildew (*Peronospora arborescens)* & Powdery mildew (*Erysiphae polygoni*) of opium poppy. A field trial was conducted during *Rabi*2021-22at Research field, RVSKVV, College of Horticulture, Mandsaur (M.P.). Each of the treatment was sprayed as per scheduled following appearance of the disease symptoms. All the treatments were found to be satisfactory in controlling the diseases. Among the six treatments, treatment T-22(T 2 :50 % Reduction in recommended spray schedule for the crop 2 spray of Metalaxyl + Mancozeb @ 0.1 % at 55 and 75

days + 1 Spray of Nativo @ 0.05 % at 95 days) + PSAP @ 6 g/litre recorded minimum downy mildew (15.25%) and powdery mildew disease incidence (9.50 %) and maximum latex, seed and husk yield (55.00kg, 690.00 kg&717.50 kg/ha) it was at par with treatmentT-13 (T1 :3 recommended schedule spray of Metalaxyl + Mancozeb @ 0.2 % at 35, 55 and 75 days + 2 spray of Nativo @ 0.1 % at 75 and 95 days) + PSAP@ 6 g/litre (16.5&10.25%,46.63 kg, 652.50 kg and 706.00 kg/ha). Whereas maximum downy mildew and powdery mildew disease incidence (29.25 % &20.25 %)minimum latex, seed and husk yield was recorded in treatment T-2 (50 % reduction in recommended schedule spray:2 spray of Metalxyl + Mancozeb @ 0.1 % at 35 and 75days and 1 spray of Nativo @ 0.05 % at 95days without PSAP) (36.25kg, 502.50 kg and 540.00 kg/ha).

Phytotoxicity

No phytotoxicity symptoms were observed at all stage of the crop growth by application of the this chemical PSAP even at double dose i.e.,12 ml/litre water at 1st, 3rd, 5th, 7thand 10thdays after first application as presented in the Table 3.

11. Summary: From above experiment it is evident that the foliar spray of 50 % reduction of recommended spray for the crop + with PSAP @ 6 gm / litreshows maximum reduction in disease incidences and maximum increase in seed yield, latex and husk yield without any symptoms of phytotoxicity.There is a reduction in use of fungicides due to PSAP chemical when it is used in combination with less dose of fungicides.

Table: 1: Bio-efficacy of foliar spray of PASP on Downy mildew and Powdery mildew diseasesof Opium poppy.

S. No	Treatment	Plant Height (cm)	Downy Mildew PDI (%)			Powdery Mildew PDI (%)		
			Initial	Final	Decrease in PDI (%)	Initial	Final	Decrease in PDI (%)
T 1	Recommended spray schedule for the crop (3 spray of Metalaxyl + Mancozeb @ 0.2 % at 35, 55 and 75 days + 2 spray of Nativo @ 0.1 % at 75 and 95 days) without PSAP	107.50	5.50 (13.49)	18.75 (25.61)	35.90	5.00 (12.89)	11.75 (19.98)	41.98
T 12	T1 + (recommended schedule spray + with foliar spray of PSAP@ 4 g/litre	106.25	7.00 (15.32)	18.00 (25.05)	38.46	5.75 (13.810	11.25 (19.58)	44.44
T 13	T1 + (recommended schedule spray + with foliar spray of PSAP@ 6 g/litre	108.25	6.50 (14.76)	16.50 (23.94)	43.59	5.25 (13.18)	10.25 (18.67)	49.38
T 2	50 % Reduction in recommended spray schedule for the crop (2 spray of Metalaxyl + Mancozeb @ 0.1 % at 55 and 75 days + 1 Spray of Nativo @ 0.05 % at 95 days) without PSAP	102.75	6.25 (14.45)	29.25 (32.70)	-	5.50 (13.49)	20.25 (26.74)	-
T 21	T 2 (50 % Reduction in recommended spray schedule for the crop + with foliar spray of PSAP@ 4g/litre	102.75	6.25 (14.45)	18.25 (25.24)	37.61	4.75 (12.54)	11.50 (19.81)	43.21
T 22	T 2 (50 % Reduction in recommended spray schedule for the crop + with foliar spray of PSAP @ 6 g/litre	105.25	6.00 (14.10)	15.25 (22.97)	47.86	5.75 (13.84)	9.50 (17.95)	53.09
	S. Em (±)	1.02	0.32	0.50	-	0.32	0.27	-
	CD(0.05)	NS	NS	1.51	-	NS	0.81	-
	CV (5%)	3.87	8.85	7.75	-	9.57	5.25	-

*Parenthesis shows angular transformed value

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Table: 2: Bio-efficacy of foliar spray of PASP on Seed latex and Husk yield of Opium poppy.

S. No	Treatment	Latex yield (kg)		Seed yield (kg)		Seed yield increase (%)	Husk yield (kg)		Morphine (%)
		10 ari	ha	10 ari	ha		10 ari	Ha	
T 1	Recommended spray schedule for the crop (3 spray of Metalaxyl + Mancozeb @ 0.2 % at 35, 55 and 75 days + 2 spray of Nativo @ 0.1 % at 85 and 100 days) without PSAP	4.12	41.25	61.75	617.50	22.89	62.88	628.75	11.56
T 12	T1 (recommended schedule spray) + with foliar spray of PSAP@ 4 g/litre	4.65	46.50	64.63	646.25	28.61	65.00	650.00	12.23
T 13	T1 (recommended schedule spray) + with foliar spray of PSAP@ 6 g/litre	4.66	46.63	65.25	652.50	29.85	70.63	706.25	12.52
T 2	50 % Reduction in recommended spray schedule for the crop (3 spray of Metalaxyl + Mancozeb @ 0.1 % at 55 and 75 days + 1 Spray of Nativo @ 0.05 % at 90 days) without PSAP	3.62	36.25	50.25	502.50	-	54.00	540.00	11.18
T 21	T 2 (50 % Reduction in recommended spray schedule for the crop) + with foliar spray of PSAP@ 4g/litre	4.25	42.50	63.88	638.75	27.11	64.38	643.75	12.52
T 22	T 2 (50 % Reduction in recommended spray schedule for the crop + with foliar spray of PSAP @ 6 g/litre	5.50	55.00	69.00	690.00	37.31	71.75	717.50	12.77
	S. Em (±)	0.11	1.11	0.77	7.66	-	0.87	8.68	-
	CD (0.05)	0.34	3.36	2.31	23.08	-	2.62	26.17	-
	CV (5%)	9.97	9.97	4.90	4.90	-	5.36	5.36	-

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Table: 3. Phytotoxicity of PSAP- Potassium Salt of Active Phosphorus on opium plant during *Rabi* 2021-22

Sl. No.	Treatments	Phytotoxicity symptoms At 1,3,5,7 and 10 Days after application of test chemical																													
		Chlorosis					Necrosis					Wilting					Scorching					Hyponasty					Epinasty				
		1	3	5	7	10	1	3	5	7	10	1	3	5	7	10	1	3	5	7	10	1	3	5	7	10	1	3	5	7	10
1	PSAP- @ 8 g/litre at 35 DAS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	PSAP- @ 12 g/litre at 35 DAS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Control	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Appendix: Meteorological data during experimental period 2021-22

MSW	Period	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)
		Max	Min	Max	Min	
45	5 – 11 Nov	27.16	9.00	87.86	30.29	0.00
46	12–18 Nov	26.01	8.27	92.43	59.86	1.93
47	19 - 25 Nov	27.30	10.73	90.43	36.14	0.00
48	26-02 Dec	20.83	13.70	91.43	60.14	1.14
49	3 - 09 Dec	23.66	12.76	91.29	53.43	0.00
50	10 - 16 Dec	21.21	10.74	87.90	46.92	0.00
51	17 - 31 Dec	24.39	9.64	88.86	42.14	0.00
52	24 - 31 Dec	18.94	9.06	93.57	67.29	0.00
01	01-07 Jan	21.61	21.30	93.14	61.43	0.00
02	08 -14 Jan	17.01	3.07	91.86	58.14	0.00
03	15-21 Jan	21.27	8.04	90.14	43.86	0.00
04	22-28 Jan	20.57	6.73	90.57	37.57	0.00
05	29 – 04 Feb	25.21	11.77	85.57	35.29	0.00
06	05-11 Feb	24.11	5.43	87.29	37.00	0.00
07	12-18 Feb	25.60	8.09	84.29	31.14	0.00
08	19 -25 Feb	28.90	9.34	85.00	32.86	0.00
09	26-04 March	29.60	9.54	81.71	29.43	0.00
10	05- 11 March	31.87	13.34	86.71	31.86	18.43
11	12-18 March	37.19	15.37	66.57	19.00	0.00
12	19-25 March	36.04	16.34	56.14	20.00	0.00
13	29-4-Apr-2022	38.54	17.86	49.57	15.00	0.00

Source: Meteorological observatory at College of Horticulture, Mandsaur (MP)

CERTIFICATE

We certify that the work done and reported here is true and authentic on the project entitled **"Evaluation of bio-efficacy trial of research product PSAP- Potassium salt of active Phosphorus on Opium Poppy (*Papaver somniferum)*"** based on the research conducted at AICRP M&AP research field, College of Horticulture, Mandsaur (M.P), India. The field trial has been conducted during 2021-22 in accordance with the standard guidelines and protocols and the results presented here are faithful reflection of data collected during the study.

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13/12/22

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Dean
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Mandsaur