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

2019-20

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

Submitted by

Dr. R. S. Chundawat
Pr. Scientist AICRP M&AP

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

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**	:	Dr. R.S. Chundawat (PI) Pr. Scientist AICRP M&AP 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* 2019-20
c. Year	:	2019-20
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
6. Experimental Details		
a. Design	:	Randomized Block Design

Principal Scientist
KNK College of Horticulture
Mandsaur (M.P.)

B.K. Patidar
Asstt. Professor (Plpatho)
College of Horticulture Mandsaur (M.P.)

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	:	18/11/2019	
h. Date of PSAP applications		1st Spray	23/12/2020
		2nd Spray	13/12/2020
		3rd spray	03/02/2020
		4th spray	23/02/2020

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

8. Observations recorded:

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

Principal Scientist
KNK College of Horticulture
Mandsaur (M.P.)

B. K. Patidar
Asstt. Professor (Pipatho)
College of Horticulture Mandsaur (M.P.)

9. Methodology:

The field trial was conducted during Rabi 2019-20 at AICRP M&AP Research Field, College of Horticulture, Mandsaur (M.P) to evaluate the PSAP- Potassium salt of Active Phosphorus against Downy mildew and Powdery mildew of opium poppy.

All the standard agronomic practices were followed as per the recommendations of the University 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 at recommended scheduled describe in technical.

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:

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

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

Principal Scientist
KNK College of Horticulture
Mandsaur (M.P.)

B. K. Patidar
Asstt. Professor (Plpatho)
College of Horiculture Mandsaur (M.P.)

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, 1, 3, 5, 7 and 10 days after first application using following 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* 2019-20 at research field, RVSKVV, College of Horticulture, Mandsaur. Each of the treatment was sprayed as per scheduled following appearance of the disease symptoms. All the treatments were found to be effective 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 (14.23%) and powdery mildew disease incidence (12.67 %) and maximum latex, seed and husk yield (53.85 kg, 818.85 kg & 835.87 kg/ha) it was at par with treatment T-13 (T1 :3 recommended schedule spray of Metalaxyl + Mancozeb @ 0.2 % at 35, 55

Principal Scientist
KNK College of Horticulture

B. K. Patidar
Asstt. Professor (Plpatho)
College of Horiculture Mandsaur (M.P.)

and 75 days + 2 spray of Nativo @ 0.1 % at 75 and 95 days) + PSAP@ 6 g/litre (14.94 & 13.62 %, 48.39 kg, 759.40 kg and 785.71 kg/ha). Whereas maximum downy mildew and powdery mildew disease incidence (29.94 % & 28.44 %) 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 75 days and 1 spray of Nativo @ 0.05 % at 95 days without PSAP) (39.79 kg, 557.66 kg and 581.26 kg/ha).

Phytotoxicity

No phytotoxicity symptoms were observed at all stage of the crop growth by application of the test chemical PSAP even at double dose i.e. 12 m/litre water at 1, 3, 5, 7 and 10 days 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 / litre shows maximum reduction in disease incidences and maximum increase in seed yield, latex and husk yield without any symptoms of phytotoxicity. There is a reduction of fungicides due to this chemical when it is used in combination with less dose of pesticides.

Principal Scientist
KNK College of Horticulture
Mandsaur (M.P.)

B. K. Patidar
Asstt. Professor (Plpatho)
College of Horticulture Mandsaur (M.P.)

Table: 1: Bio-efficacy of foliar spray of PASP on downy mildew and powdery mildew diseases, seed latex and husk yield of 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	118.75	5.81 (13.93)	16.08 (23.60)	46.28	4.50 (12.15)	14.58 (22.41)	48.72
T 12	T1 + (recommended schedule spray + with foliar spray of PSAP@ 4 g/litre	114.53	7.25 (15.61)	15.13 (22.85)	50.10	6.00 (14.16)	14.50 (22.03)	49.01
T 13	T1 + (recommended schedule spray + with foliar spray of PSAP@ 6 g/litre	119.45	6.69 (14.91)	14.94 (22.68)	49.48	5.75 (13.84)	13.63 (21.64)	52.09
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	118.80	6.88 (15.13)	29.94 (33.15)	-	6.00 (14.10)	28.44 (32.21)	-
T 21	T 2 (50 % Reduction in recommended spray schedule for the crop + with foliar spray of PSAP@ 4g/litre	116.54	7.19 (15.49)	17.29 (24.49)	42.25	6.50 (14.72)	15.79 (23.36)	44.48
T 22	T 2 (50 % Reduction in recommended spray schedule for the crop + with foliar spray of PSAP @ 6 g/litre	115.24	5.94 (14.08)	14.23 (22.13)	52.47	5.00 (12.89)	12.67 (20.84)	55.45
	S. Em (±)	1.61	0.38	0.65	-	0.32	0.41	-
	CD (0.05)	NS	NS	1.96	-	NS	1.22	-
	CV (5%)	6.87	10.10	10.49	-	9.28	7.82	-

*parenthesis shows angular transformed value

Principal Scientist
KNK College of Horticulture
Mandsaur (M.P.)

B. K. Patidar
Asstt. Professor (Plpatho)
College of Horiculture Mandsaur (M.P.)

Table: 2: Bio-efficacy of foliar spray of PASP on downy mildew and powdery mildew diseases, 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	4.27	42.65	62.55	625.48	12.16	65.05	650.476	11.9
T 12	T1 + (recommended schedule spray + with foliar spray of PSAP@ 4 g/litre	4.47	44.67	71.46	714.56	28.14	71.70	716.983	12.6
T 13	T1 + (recommended schedule spray + with foliar spray of PSAP@ 6 g/litre	4.84	48.39	75.94	759.40	36.18	78.57	785.714	12.9
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	3.98	39.79	55.77	557.66	-	58.13	581.269	11.3
T 21	T 2 (50 % Reduction in recommended spray schedule for the crop + with foliar spray of PSAP@ 4g/litre	4.36	43.65	68.24	682.38	22.37	64.20	641.984	12.6
T 22	T 2 (50 % Reduction in recommended spray schedule for the crop + with foliar spray of PSAP @ 6 g/litre	5.38	53.85	81.88	818.85	46.84	83.59	835.872	12.8
	S. Em (±)	0.14	1.42	2.16	21.64	-	1.87	18.65	-
	CD (0.05)	0.43	4.27	6.52	65.22	-	5.62	56.23	-
	CV (5%)	12.46	12.46	1.25	12.49	-	1.06	10.63	-

Principal Scientist
KNK College of Horticulture
Mandsaur (M.P.)

B. K. Patidar
Asstt. Professor (Plpatho)
College of Horticulture Mandsaur (M.P.)

Table: 3. Phytotoxicity of PSAP- Potassium Salt of Active Phosphorus on opium plant during *Rabi* 2019-20

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

Principal Scientist
KNK College of Horticulture
Mandsaur (M.P.)

B. K. Patidar
Asstt. Professor (Plantho)
College of Horticulture Mandsaur (M.P.)

Appendix : Meteorological data during experimental period 2019-20

SM Week	Period	Temperature (°C)		Relative Humidity (%)	Rainfall (mm)
		Max	Min		
40	1 - 7 Oct	19.29	29.86	71	0.00
41	8 - 14 Oct	20.14	29.14	77	0.00
42	15 - 21 Oct	18.57	29.57	66	0.00
43	22 - 28 Oct	15.29	29.14	59	0.00
44	29 Oct - 4 Nov	16.29	29.09	68	0.00
45	5 – 11 Nov	14.29	27.14	74	0.00
46	12–18 Nov	11.14	24.71	76	0.00
47	19 - 25 Nov	9.71	21.57	81	0.00
48	26 Nov -2 Dec	11.14	22.43	74	0.00
49	3 - 09 Dec	9.14	21.00	77	0.00
50	10 - 16 Dec	8.00	22.57	73	0.00
51	17 - 31 Dec	9.29	23.29	77	0.00
52	24 - 31 Dec	10.86	24.57	72	0.00
01	01-07 Jan	9.14	20.86	81.57	0.00
02	08 -14 Jan	8.43	22.86	73.71	0.00
03	15-21 Jan	9.00	23.57	76.00	0.00
04	22-28 Jan	11.29	24.57	70.43	0.00
05	29 Jan – 04 Feb	10.43	24.14	70.14	0.00
06	05-11 Feb	10.43	24.43	67.43	0.00
07	12-18 Feb	13.86	29.14	75.86	0.00
08	19 -25 Feb	14.14	32.71	68.86	0.00
09	26Feb- 04 March	14.88	31.38	65.50	0.00
10	05- 11 March	15.43	28.71	60.43	0.00
11	12-18 March	16.29	30.14	60.14	0.00
12	19-25 March	18.86	33.43	61.71	0.00
13	26 March-01April	20.00	33.86	64.29	0.00

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

Principal Scientist
KNK College of Horticulture
Mandsaur (M.P.)

B. K. Patidar
Asstt. Professor (Plpathc)
College of Horticulture Mandsaur (M.P.)

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 2019-20 in accordance with the standard guidelines and protocols and the results presented here are faithful reflection of data collected during the study.

(B.K. Patidar)
Asstt. Professor (Pl. Pathology)
College of Horticulture
Mandsaur (M.P.)

(R. S. Chundawat)
Principle. Scientist, AICRP M&AP
College of Horticulture
Mandsaur (M.P.)

Dean
CoH, Mandsaur