REPORT

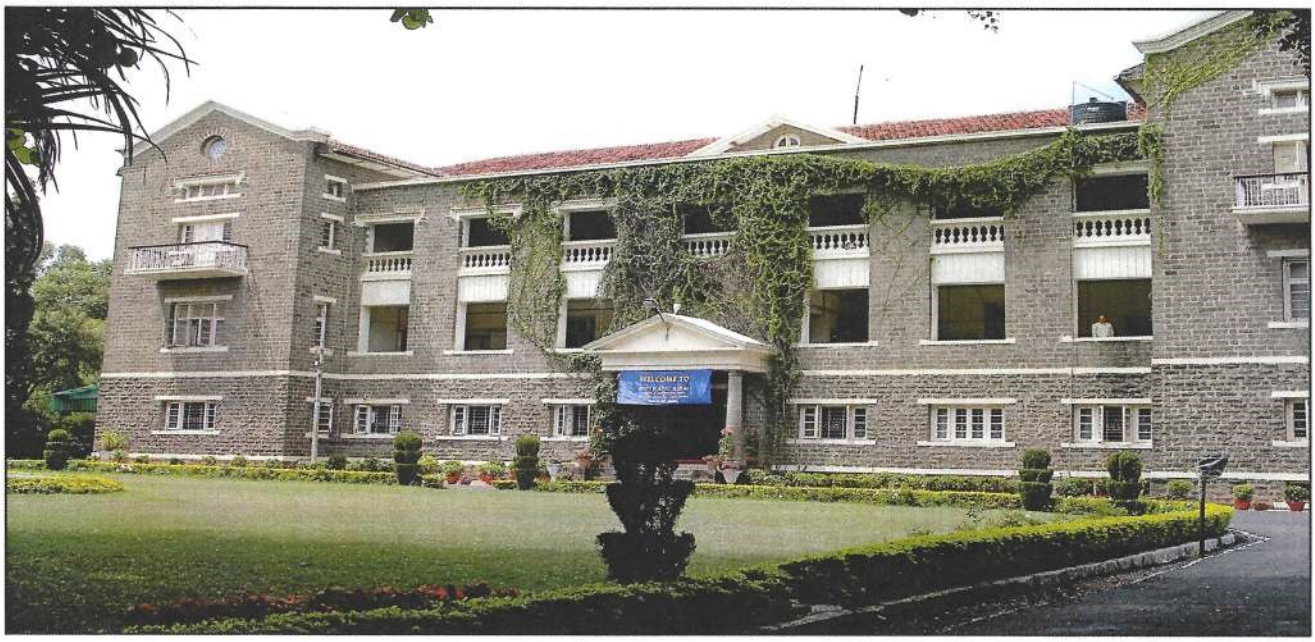
ON

ASSESSMENT OF THE ABSORPTION OF PHOSPHORUS, POTASSIUM AND SODIUM APPLIED THROUGH PSAP BY MAIZE CROP

OF

ISHA AGRO SCIENCES PVT. LTD.

(2022)



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महाराष्ट्र असोसिएशन फॉर द कल्टिव्हेशन ऑफ सायन्स
आघारकर अनुसंधान संस्थान
(विज्ञान और प्रौद्योगिकी विभाग, भारत सरकार के अधिन स्वायत्त संस्थान)
गो. ग. आगरकर पथ, पुणे – ४११ ००४.

Maharashtra Association for the Cultivation of Science
AGHARKAR RESEARCH INSTITUTE
(An Autonomous Body under the Department of Science and Technology, Govt. of India)
G. G. Agarkar Road, Pune - 411 004.

PRODUCT TESTING TRIAL

ON

ASSESSMENT OF THE ABSORPTION OF PHOSPHORUS, POTASSIUM AND SODIUM APPLIED THROUGH PSAP BY MAIZE CROP AT MACS-AGHARKAR RESEARCH INSTITUE, PUNE

Title of experiment	:	Assessment of the absorption of Phosphorus and Potassium applied through PSAP by Maize crop
Objective:		1) To assess the absorption of nutrients through foliage by Maize at various stages of growth
Name and address of the sponsorer	:	ISHA AGRO SCIENCES PVT. LTD., PUNE Sr. No. 17/2C, Ashwamedh Bunglow, Ambedkar Chowk, Shahanu Patel School Road, Warje, Pune 411 058
Location	:	Experimental Farm at Hol-Sortewadi, Tal. Baramati, Dist. Pune of MACS-Agharkar Research Institute, G.G. Agarkar Road, Pune 411 004.
Duration of the project	:	2021-22 (One Year)
Name of scientist	:	Mr. S. A. Jaybhay
Name of Product tested	:	**Potassium Salt of Active Phosphorus (PASP)**
Crop	:	Maize
Variety	:	Maize: Gold 1166 (Hybrid)
Institute acceptance/ consent letter number	:	3/478/2021/711 Dated 03/01/2022

General Information about the Maize field trial conducted

1.	Location	:	ARI, Research Farm, Hol-Sortewadi, Taluka Baramati, District Pune.
2.	Season	:	*Rabi* 2021-22
3.	Crop	:	Maize
4.	Variety	:	Gold 1166 (Hybrid)
5.	No. of treatments	:	Seven
6.	Design	:	RBD
7.	No. of replications	:	Three
8.	Spacing	:	2 ft. between rows
9.	Plot size	:	3 m x 3 m
10.	Date of sowing	:	17/01/2022
11.	Date of harvest (Pickings)	:	23/06/2022
12.	Recommended dose of fertilizer	:	120:60:40 kg NPK/ha
13.	Product under testing applied	:	As per treatments given in Table 1
14.	Method of application	:	Foliar application at 30, 45 and 60 days after sowing
15.	Previous crop	:	Soybean
16.	Soil type	:	Medium black
17.	Irrigations given	:	Five
18.	Initial soil nutrition status (OC%, Available P & K kg/ha)	:	

PH	EC	OC	N	P	K
7.59	0.44 (dS/m)	(%) 0.70	183.68 kg/ha	28.22 kg/ha	201.6 kg/ha

19.	Occurrence of diseases	:	Nil
20.	Occurrence of insect-pests	:	Nil
21.	Plant protection measures		
	i) Seed treatment	:	Seed treatment with Carbendazim 3 g/kg seed
	ii) Soil application of insecticides/ fungicides	:	Nil

iii) Post emergence application of insecticides/fungicides :

iv) Sprayer used : HTP Sprayer

Table 1: Treatment wise dose of fertilizers & quantity of fertilizers to be used with time of application.

Sr. No.	Treatments
1.	T1: RDF + PSAP 4 g /lit. water
2.	T2: RDF + PSAP 6 g /lit. water
3.	T3: RDF + 19:19:19 4 g /lit. water
4.	T4: RDF + 19:19:19 6 g/lit water
5.	T5: RDF + 00:52:34 4 g/lit water
6.	T6: RDF + 00:52:34 6 g/lit water
7.	T7: RDF + Water spray (Control)

Foliar sprays after 30, 45 and 60 days after sowing (DAS).

Table 2: Quantity of nutrients applied through spray

Treatment	Dose (g/lit)	Dose (kg/ha)	Quantity of Nutrient (kg/ha)	
			P2O5	K2O
T1: RDF + PSAP 4 g /lit. water	4	2.00	0.8	0.8
T2: RDF + PSAP 6 g /lit. water	6	3.00	1.2	1.2
T3: RDF + 19:19:19 4 g /lit. water	4	2.00	0.38	0.38
T4: RDF + 19:19:19 6 g/lit water	6	3.00	0.57	0.57
T5: RDF + 00:52:34 4 g/lit water	4	2.00	1.04	0.68
T6: RDF + 00:52:34 6 g/lit water	6	3.00	1.56	1.02
T7: RDF + Water spray (Control)	-	-	-	-

Details of Observations: Biometric observations on plant height, number of cobs per plant and dry matter per plant were recorded on randomly selected five plants per plot. Yield attributing traits *viz.*, yield per plot and biological yield was recorded. Available soil nutritional status of the representative soil sample from experimental plot was determined before sowing. Nutrient absorption was determined by analyzing the plant samples for P, K & Na nutrient and arsenic and lead elemental content and before 30, 45 and 60 DAS and after 30, 45 and 60 DAS, respectively.

TABLE 3: EFFECT ON GROWTH ATTRIBUTES OF MAIZE

Location: MACS-ARI Hol Farm, Baramati, Distt. Pune

Variety: Gold 1166 (Hybrid)

Treatments	Increase in dry matter content (g/plant) after application			Dry matter (g) per plant			Crop growth rate		Relative growth rate	
	30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS	30-45 DAS	45-60 DAS	30-45 DAS	45-60 DAS
T1: RDF + PSAP 4 g /lit. water	41.00	28.40	44.67	14.37	25.05	73.23	0.712	3.212	0.0160	0.0310
T2: RDF + PSAP 6 g /lit. water	41.53	33.17	45.70	15.32	24.71	77.82	0.626	3.540	0.0140	0.0330
T3: RDF + 19:19;19 4 g /lit. water	38.90	25.13	38.20	14.03	23.04	73.89	0.600	3.390	0.0143	0.0336
T4: RDF + 19:19:19 6 g/lit water	38.63	25.47	39.20	13.42	23.29	72.85	0.658	3.303	0.0156	0.0330
T5: RDF + 0:52:34 4 g/lit water	37.73	25.00	41.20	12.72	23.27	72.49	0.703	3.282	0.0176	0.0333
T6: RDF + 0:52:34 6 g/lit water	38.23	21.67	37.87	12.51	22.75	68.46	0.682	3.047	0.0173	0.0317
T7: RDF + Water spray (Control)	34.43	19.43	37.07	12.07	22.55	67.49	0.699	2.995	0.0180	0.0317
SE m	1.715	1.66	1.86	0.750	0.975	2.231	0.107	0.178	0.026	0.016
CD at 0.05%	NS	5.10	5.73	NS	NS	NS	NS	NS	NS	NS

TABLE 4: YIELD RESPONSE OF MAIZE TO PSAP

Location: MACS-ARI Hol Farm, Baramati, Distt. Pune Variety: Gold 1166 (Hybrid)

Treatments	Plant height (cm)	No. of cobs/ plant	Harvest index (%)	1000 Seed weight (g)	Seed yield (kg/plot)	Seed yield (kg/ha)
T1: RDF + PSAP 4 g /lit. water	189	1.00	26.60	336.00	9.64	10707
T2: RDF + PSAP 6 g /lit. water	198	1.00	28.94	337.33	9.88	10974
T3: RDF + 19:19;19 4 g /lit. water	187	1.00	25.91	321.33	9.06	10067
T4: RDF + 19:19:19 6 g/lit water	189	1.00	27.77	328.00	9.49	10544
T5: RDF + 0:52:34 4 g/lit water	190	1.00	25.34	327.33	9.01	10011
T6: RDF + 0:52:34 6 g/lit water	179	1.00	26.47	340.33	8.68	9640
T7: RDF + Water spray (Control)	189	1.00	27.07	313.33	8.12	9022
SE m	5.95	-	1.023	6.66	0.336	373.97
CD at 0.05%	NS	-	NS	NS	1.035	1151.73

TABLE 5: NUTRIENT ABSORPTION (%) BY MAIZE BEFORE AND AFTER FOLIAR APPLICATION

Location: MACS-ARI Hol Farm, Baramati, Distt. Pune

Variety: Gold 1166 (Hybrid)

Treatments	Phosphorus (%)		Potassium (%)		Sodium (%)		Phosphorus (%)		Potassium (%)		Sodium (%)		Phosphorus (%)		Potassium (%)		Sodium (%)		Arsenic (ppm)	Lead (ppm)
	30 DBA	30 DAA	30 DBA	30 DAA	30 DBA	30 DAA	45 DBA	45 DAA	45 DBA	45 DAA	45 DBA	45 DAA	60 DBA	60 DAA	60 DBA	60 DAA	60 DBA	60 DAA	60 DBA	60 DAA
T1: RDF + PSAP 4 g /lit. water	0.44	0.37	1.70	1.25	0.10	0.20	0.34	0.35	1.30	0.35	0.08	0.18	0.30	0.17	1.68	1.47	0.16	0.15	< 1.0	<0.5
T2: RDF + PSAP 6 g /lit. water	0.44	0.34	1.42	1.13	0.08	0.13	0.33	0.33	1.48	0.33	0.08	0.15	0.27	0.16	1.27	1.40	0.10	0.10	< 1.0	<0.5
T3: RDF + 19:19;19 4 g/lit. water	0.40	0.38	1.67	1.13	0.13	0.15	0.36	0.36	1.60	0.36	0.11	0.12	0.25	0.17	1.30	1.48	0.08	0.12	< 1.0	<0.5
T4: RDF + 19:19:19 6 g/lit water	0.51	0.35	1.50	1.10	0.17	0.16	0.30	0.34	1.10	0.34	0.30	0.12	0.25	0.23	1.33	1.50	0.17	0.28	< 1.0	<0.5
T5: RDF + 0:52:34 4 g/lit water	0.44	0.36	1.57	1.23	0.05	0.17	0.35	0.39	1.35	0.39	0.11	0.08	0.26	0.19	1.38	1.33	0.15	0.15	< 1.0	<0.5
T6: RDF + 0:52:34 6 g/lit water	0.48	0.34	1.53	1.08	0.12	0.12	0.34	0.33	1.25	0.33	0.05	0.17	0.26	0.19	0.95	1.23	0.10	0.12	< 1.0	<0.5
T7: RDF + Water spray (Control)	0.51	0.33	1.58	0.83	0.12	0.12	0.34	0.37	1.10	0.37	0.07	0.13	0.24	0.20	1.07	1.30	0.16	0.13	< 1.0	<0.5
SE m	0.027	0.015	0.181	0.143	0.027	0.031	0.013	0.022	0.185	0.022	0.066	0.035	0.021	0.020	0.088	0.204	0.022	0.049		
CD at 0.05%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS		

DBA: Days before application, DAA: Days after application

TABLE 6: NUTRIENT UPTAKE, SOIL NUTRITION STATUS AND NUTRIENT BALANCE SHEET

Location: MACS-ARI Hol Farm, Baramati, Distt. Pune

Variety: Gold 1166 (Hybrid)

Initial Soil Nutrition Status	P (kg/ha)	K (kg/ha)	Na (kg/ha)
	28.22	201.6	0.32

Treatments	Nutrient Uptake			Nutrients Applied		Nutrient Removal			Available soil nutrients status			Gain/ Loss		
	P (kg/ha)	K (kg/ha)	Na (kg/ha)	P (kg/ha)	K (kg/ha)	P (kg/ha)	K (kg/ha)	Na (kg/ha)	P (kg/ha)	K (kg/ha)	Na (kg/ha)	P (kg/ha)	K (kg/ha)	Na (kg/ha)
T1: RDF + PSAP 4 g /lit. water	146.69	1268.40	129.43	62.83	43.38	335.91	1522.08	0.0129	32.6	250	0.301	4.38	48.4	-0.0190
T2: RDF + PSAP 6 g /lit. water	130.10	1138.33	81.31	64.24	45.08	297.92	1366.00	0.0081	35.5	235	0.289	7.28	33.4	-0.0310
T3: RDF + 19:19;19 4 g/lit. water	142.27	1238.62	100.43	61.70	41.91	325.81	1486.34	0.0100	38.6	260	0.309	10.38	58.4	-0.0110
T4: RDF + 19:19:19 6 g/lit water	187.45	1222.50	228.20	62.55	42.87	429.26	1467.00	0.0228	31.2	235	0.289	2.98	33.4	-0.0310
T5: RDF + 0:52:34 4 g/lit water	162.40	1136.83	128.21	64.38	42.88	371.91	1364.20	0.0128	30.6	244	0.331	2.38	42.4	0.0110
T6: RDF + 0:52:34 6 g/lit water	147.57	955.30	93.20	66.58	44.32	337.93	1146.36	0.0093	33.5	251	0.298	5.28	49.4	-0.0220
T7: RDF + Water spray (Control)	143.05	929.81	92.98	62.83	43.38	327.58	1115.77	0.0093	41.6	215	0.289	13.38	13.4	-0.0310

TABLE 7: Nutrient and element content of soil after harvest

Representative soil sample	Before sowing		
	Arsenic (ppb)	**Lead (ppb)**	**Organic carbon (%)**
	BDL	9.50	0.69
Treatments	**After harvest**		
	Arsenic (ppb)	**Lead (ppb)**	**Organic carbon (%)**
T1: RDF + PSAP 4 g /lit. water	BDL	12.3	0.77
T2: RDF + PSAP 6 g /lit. water	BDL	8.30	0.71
T3: RDF + 19:19;19 4 g /lit. water	BDL	13.6	0.74
T4: RDF + 19:19:19 6 g/lit water	BDL	10.3	0.71
T5: RDF + 0:52:34 4 g/lit water	BDL	10.28	0.64
T6: RDF + 0:52:34 6 g/lit water	BDL	6.50	0.74
T7: RDF + Water spray (Control)	BDL	11.8	0.74

BDL: Below detectable level; ppb: parts per billion

TABLE 8: Quantification of phosphorus and potassium removal from soil

Tr No	Treatments	Initial soil available P (kg/ha)	After harvest soil available P (kg/ha)	P Removal from soil (kg/ha)	Initial soil available K (kg/ha)	After harvest soil available K (kg/ha)	K Removal from soil (kg/ha)
1	RDF + PSAP 4 g /lit. water	28.22	32.6	-4.38	201.6	250	-48.4
2	RDF + PSAP 6 g /lit. water	28.22	35.5	-7.28	201.6	235	-33.4
3	RDF + 19:19;19 4 g/lit. water	28.22	38.6	-10.38	201.6	260	-58.4
4	RDF + 19:19:19 6 g/lit water	28.22	31.2	-2.98	201.6	235	-33.4
5	RDF + 0:52:34 4 g/lit water	28.22	30.6	-2.38	201.6	244	-42.4
6	RDF + 0:52:34 6 g/lit water	28.22	33.5	-5.28	201.6	251	-49.4
7	RDF + Water spray (Control)	28.22	41.6	-13.38	201.6	215	-13.4

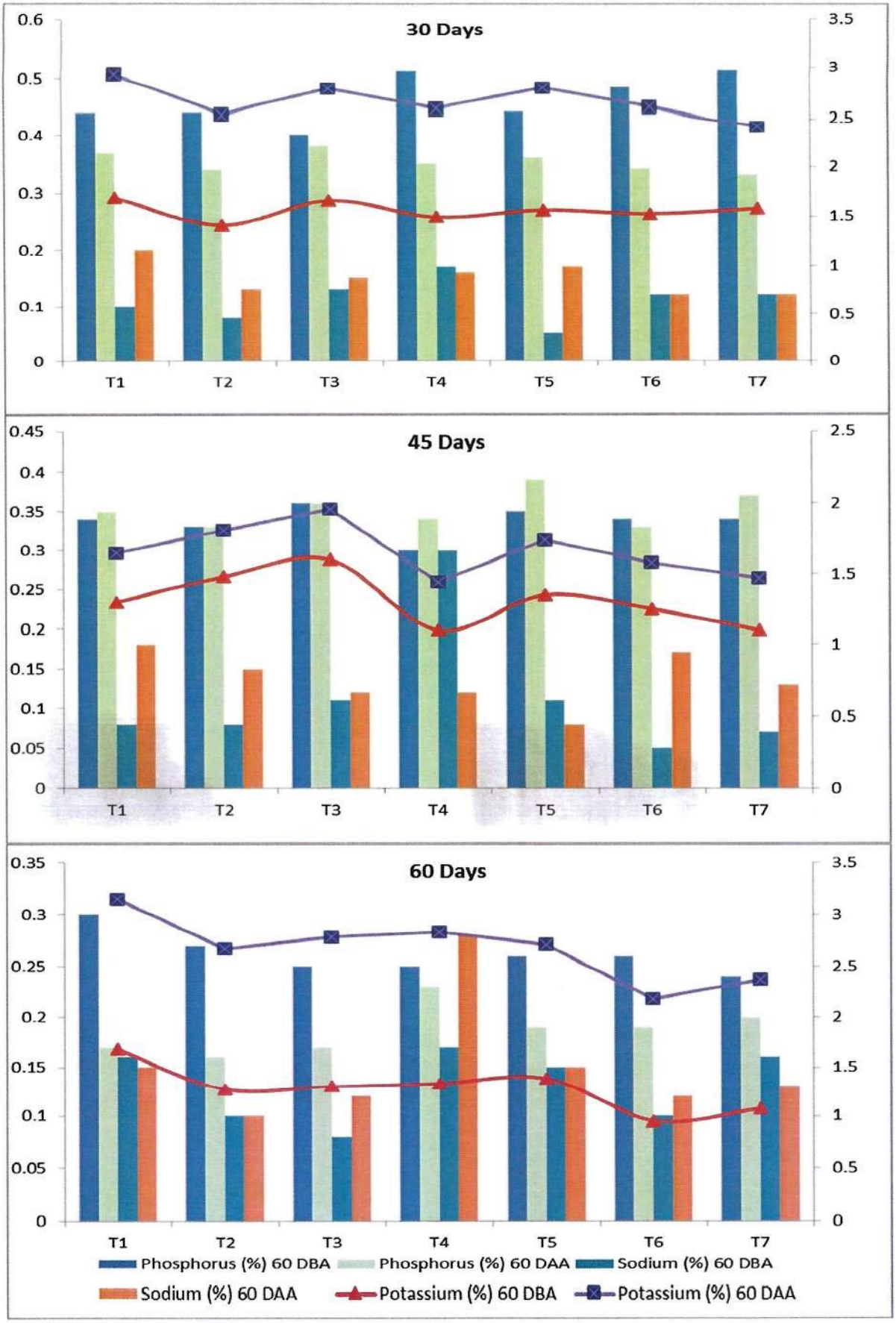
TABLE 9: Phosphorus and Potassium uptake from foliar spray of fertilizer

Tr No	Treatments	Total P uptake (kg/ha)	Contribution of soil (kg/ha)	P uptake due to fertilizers (kg/ha)	P uptake from soil applied fertilizer (kg/ha)	P uptake due to foliar spray of fertilizer (kg/ha)	Total K uptake (kg/ha)	Contribution of soil (kg/ha)	K uptake due to fertilizers (kg/ha)	K uptake from soil applied fertilizer (kg/ha)	K uptake due to foliar spray of fertilizer (kg/ha)
a	b	c	d *i.e.* nutrient removal from soil	e *i.e. c-d*	f *i.e.* P uptake of T7	g	c	d *i.e.* nutrient removal from soil	e *i.e. c-d*	f *i.e.* P uptake of T7	g
1	RDF + PSAP 4 g /lit. water	146.69	-4.38	151.07	143.05	8.02	1268.4	-48.4	1316.80	943.21	373.59
2	RDF + PSAP 6 g /lit. water	130.1	-7.28	130.10	143.05	-12.95	1138.33	-33.4	1171.73	943.21	228.52
3	RDF + 19:19;19 4 g/lit. water	142.27	-10.38	142.27	143.05	-0.78	1238.62	-58.4	1297.02	943.21	353.81
4	RDF + 19:19:19 6 g/lit water	187.45	-2.98	187.45	143.05	44.40	1222.5	-33.4	1255.90	943.21	312.69
5	RDF + 0:52:34 4 g/lit water	162.4	-2.38	162.40	143.05	19.35	1136.83	-42.4	1179.23	943.21	236.02
6	RDF + 0:52:34 6 g/lit water	147.57	-5.28	147.57	143.05	4.52	955.3	-49.4	1004.70	943.21	61.49
7	RDF + Water spray (Control)	143.05	-13.38	143.05	143.05		929.81	-13.4	943.21	943.21	0.00

TABLE 10: Effect of PSAP on yield, nutrient uptake and Physiological Nutrient Use Efficiency of P & K in maize

Tr. No.	Treatments	Grain yield (kg/ha)	Nutrient Uptake (kg/ha)		Physiological Nutrient Use Efficiency	
			P	K	P	K
1.	RDF + PSAP 4 g /lit. water	10707	146.69	1268.40	462.9	5.0
2.	RDF + PSAP 6 g /lit. water	10974	130.10	1138.33	-150.7	9.4
3.	RDF + 19:19;19 4 g /lit. water	10067	142.27	1238.62	-1339.7	3.4
4.	RDF + 19:19:19 6 g/lit water	10544	187.45	1222.50	34.3	5.2
5.	RDF + 0:52:34 4 g/lit water	10011	162.40	1136.83	51.1	4.8
6.	RDF + 0:52:34 6 g/lit water	9640	147.57	955.30	136.7	24.2
7.	RDF + Water spray (Control)	9022	143.05	929.81	462.9	5.0
	SE m	373.97				
	CD at 0.05%	1151.73				

Figure 1: Nutrient Absorption (%) by Maize before and after foliar application



Results:

Effect on growth attributes:

The data on growth and its attributes presented in Table 3. The differences for growth attributes *viz.*, plant dry matter per plant at 30, 45 and 60 days after sowing (DAS), crop growth rate (CGR) and relative growth rate (RGR) at 30-45 and 45-60 DAS were non-significant in various treatments studied. The difference between plant dry matter content before and after application of the treatments at 45 and 60 DAS was significantly high in treatment T2: RDF + PSAP 6 g/lit. water over T7: RDF + water spray (control) and at par with rest of the treatments. Similarly, the plant height at harvest was non significantly different among the treatments.

Effect on yield and its attributes:

Among the yield and its attributes, the differences for number of cobs per plant and 1000 seed weight were numerically similar (Table 4). However, the seed yield was significantly higher under treatment T2- RDF + PSAP 6 g/lit. water (10974 kg/ha) over treatment T7- RDF + water spray (9022 kg/ha) and at par with the treatments T1, T3, T4 and T5. Increase in seed yield of maize in treatment T2- RDF + PSAP 6 g/lit. water was 21.64% over T7- RDF + water spray (control).

Effect of soil nutrition status and nutrient uptake by crop:

The data on the nutrient absorption at 30, 45 and 60 days after sowing by maize plants is presented in Table 5. The values of the nutrient absorption at 30, 45 & 60 DBS and DAA were non significantly different due to various treatments of foliar application. The differences for Arsenic and Lead absorption was observed non significantly different for all the treatments (<1 and <0.5%, respectively). Whereas, nutrient and element content of the soil before sowing and after harvest showed non consistent trend between the different treatments studied. This might be due to the first year of testing.

Nutrient uptake, Soil nutrition status and nutrient balance sheet:

Uptake of nutrients based on the biological yield of maize crop showed the in consistency among the various treatment and were numerically different over the control (Table 6). Soil nutrient content of the soil after harvest of maize crop has recorded increase over its intimal values, hence it turned into the net gain in phosphorus, potassium and sodium in soil.

Quantification of the phosphorus and potash removal by plant from soil and its uptake due to foliar application of the fertilizers:

The values for Phosphorus and potash removal by maize from soil (Table 8) was in negative values, as the after-harvest values for the phosphorus and potassium are greater than the initial.

Uptake of phosphorus due to foliar application of fertilizers (Table 9) showed the inconsistent trend among the different treatments studied. Potassium uptake due to foliar application of fertilizers was maximum with treatments RDF + PSAP 4 g/lit of water (374 kg/ha) and RDF + 19:19:19 4 g/lit of water (354 kg/ha) followed by rest of the treatments.

Physiological nutrient use efficiency:

Physiological nutrient use efficiency of Phosphorus and potassium in terms of ability of plant to transform nutrients acquired from fertilizer into economic yield was varying under different treatments (Table 10).

10.01.23
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View of field trial at ARI Hol Farm