

Effect of Lucerne Hay Soil Application Foliar Spray of Juice on Yield, Nutrient Content and Uptake by IR-20 Rice

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The influence of lucerne hay soil as well as foliar application of the juice revealed that soil application of lucerne hay significantly increased the N, P and K contents in the rice grain and straw samples over absolute control and lucerne juice spray. NPK plus lucerne hay soil applied pots registered higher nutrient contents in the grain and straw of IR 20 rice as well as uptake of the nutrients than the other treatments. The available N status in the post-harvest soil samples was higher under NPK plus lucerne hay soil applied pots and that of P under NPK plus three foliar application of lucerne juice treatments. Highest available K in the soil was noticed in the pots which received the treatment NPK plus lucerne hay soil application and one foliar spray of lucerne juice on 25th day of planting.

Alfalfa meal and chloroform extracts of the meal have increased the growth and yield of several plant species (Ries *et al.*, 1977). Coarsely chopped alfalfa hay increased growth and yield of corn when placed in a band below and to the side of the crop seeds or seedlings (Anon, 1978). In field tests, researchers found the chemical triacontanol extracted from lucerne, boosted yield in some crops any where from 8 to 63 per cent. With a view to find out the effect of lucerne hay soil application and juice sprays on the nutrient contents and uptake by IR 20 rice and to know their influence on soil available nutrient status the present investigation was taken up.

MATERIAL AND METHODS

A pot experiment using alluvial soil (pH 7.8, sandy-clay loam, CEC 24.6 me/100 g) collected from the Tamil Nadu Agricultural University Farm, was conducted to study the effect of lucerne hay soil application and juice spray on nutrient contents and uptake by IR 20 rice. The experiment was replicated thrice and the treatment combinations were as follows.

Treatment	Symbol
Absolute control	T ₀
Lucerne hay soil application at 100 g/ pot alone	T ₁
NPK plus lucerne hay soil application at 100 g/pot	T ₂

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NPK plus lucerne hay soil application plus one foliar spray of lucerne juice on 25th day after planting

T₃

NPK plus lucerne hay soil application + two foliar spray of lucerne juice on 25th and 50th day after planting

T₄

NPK plus lucerne hay soil application + three lucerne juice sprays on 25th, 50th and 75th days after planting

T₅

NPK plus one foliar application of lucerne juice spray on 25th day

T₆

NPK plus two foliar application of lucerne juice spray on 25th and 50th day after planting

T₇

NPK plus three foliar application of lucerne juice sprays on 25th, 50th and 75th day after planting

T₈

One lucerne juice spray alone on 25th day after planting

T₉

The lucerne hay was applied to the pots 15 days prior to transplanting the rice seedlings. Pots receiving NPK doses received 120 kg N/ha; 60 Kg P₂O₅/ha and 60 Kg K₂O/ha. The rice seedlings (27 days old) were transplanted at two seedlings per hill in four hills for each pot. Lucerne juice was extracted by macerating the leaves and stems. From the extracted juice, 2 g of juice was weighed and diluted to 100 ml and sprayed over the rice plants in such of those treatments which received foliar application of juice on 25th, 50th and 75th days after planting. The plants were grown to maturity and at harvest, plant and soil samples were collected.

The plant samples were dried, powdered and analysed for NPK contents. Uptake of these nutrients was calculated for grain and straw. The soil samples were analysed for available N, P and K employing suitable methods (Subbiah and Asija, 1956; Olsen *et al.*, 1954 and Stanford and English, 1949) respectively. The data were subjected to statistical scrutiny.

RESULTS AND DISCUSSION

The main yield, nutrient contents and uptake values are presented in Tables I to III respectively.

Influence of lucerne hay and juice spray on the yield of rice: From the Table 1 it could be seen that the yield of rice grain and straw were significantly influenced due to the various treatments. The increase in yield of rice grain and straw over control due to lucerne juice spray was 20.92 per cent and 78.28 per cent respectively, whereas the soil applied lucerne hay enhanced the yield of grain and straw by 10.62 per cent and 2.46 per cent respectively. Among the treatments tried NPK at 120, 60 and 60 Kg/ha plus lucerne hay at two tons/ha, recorded higher yield than the rest of the treatments.

Effect of lucerne soil application and juice sprays on nutrient content of rice

It is seen from the data (Table II) that the soil as well as juice spray of lucerne treatments had significant influence increasing the contents of NPK in both grain and straw compared to control and mere lucerne juice spray given on 25th day after planting. The increa-

TABLE I. Influence of treatments on the mean rice yield (g/pot)

Treatment	Grain	Straw	% increase over control	
			Grain	Straw
Absolute control	21.36	27.13	-	-
Lucerne hay soil application	23.63	27.80	10.62	2.46
NPK + Lucerne hay soil application	32.66	47.47	52.90	74.51
NPK + Lucerne hay soil application + one foliar spray of lucerne juice on 25th day	23.66	43.50	10.76	60.33
NPK + lucerne soil application + 2 foliar sprays on 25th and 50th day	24.50	40.00	14.70	47.43
NPK + lucerne soil application + 3 foliar sprays of lucerne juice i.e. on 25th, 50th and 75th days after transplanting	26.00	38.03	21.72	40.17
NPK + one foliar spray of lucerne juice on 25th day	28.96	30.97	35.58	14.15
NPK + two foliar spray of lucerne juice on 25th and 50th day	27.46	37.07	28.55	36.63
NPK + three foliar sprays of lucerne juice on 25th, 50th and 75th days	25.46	49.27	19.19	81.60
One foliar spray of juice alone	25.83	48.37	20.92	78.28
S.E.	0.42	0.51	-	-
CD at 5%	1.59	1.76	-	-

TABLE II. Influence of treatments on the nutrient content of IR-20 Rice (Mean of three replication)

	Grain			Straw		
	N%	P%	K%	N%	P%	K%
Absolute control	0.983	0.263	0.489	0.616	0.091	1.250
Lucerne hay soil application	1.026	0.269	0.505	0.643	0.109	1.276
NPK + lucerne hay soil application	1.163	0.368	0.583	0.766	0.162	1.386
NPK + lucerne hay soil application + one foliar spray of lucerne juice on 25th day	1.063	0.284	0.530	0.680	0.148	1.363
NPK + lucerne soil application + 2 foliar sprays on 25th day and 50th days	1.050	0.288	0.564	0.686	0.149	1.373
NPK + lucerne soil application + three foliar sprays of lucerne juice i.e., on 25th, 50th and 75th days	1.106	0.316	0.558	0.723	0.157	1.346
NPK + one foliar spray of lucerne juice on 25th day	1.146	0.328	0.552	0.730	0.158	1.340
NPK + two foliar spray of lucerne juice on 25th and 50th day	1.120	0.322	0.560	0.710	0.157	1.326
NPK 3 foliar sprays of lucerne juice on 25th, 50th and 75 days	1.080	0.297	0.547	0.693	0.148	1.310
One foliar spray of juice alone	0.980	0.262	0.492	0.630	0.098	1.270
S.E. D	0.0063	0.0017	0.0075	0.0081	0.0014	0.0019
C.D. (P=0.005)	0.0183	0.0036	0.0157	0.0164	0.0029	0.0039

TABLE III. Influence of treatments on the nutrient uptake by IR 20 Rice (mg/pot)

	Grain			Straw		
	N uptake	P uptake	K uptake	N uptake	P uptake	K uptake
Absolute control	210.11	57.12	104.54	167.33	24.69	339.15
Lucerne hay soil application	242.61	63.56	119.42	178.22	30.30	354.91
NPK + lucerne hay soil application	380.02	120.19	190.55	363.90	77.21	658.20
NPK + lucerne hay soil application + one foliar spray of lucerne juice on 25th day	251.66	67.22	125.44	291.55	64.54	593.08
NPK + lucerne hay soil application + two foliar spray of juice on 25th and 50th days	257.28	70.65	138.35	274.66	59.73	549.34
NPK + lucerne hay soil application + three foliar sprays of juice on 25th, 50th and 75th days	287.76	82.17	145.25	275.11	59.72	514.73
NPK + one foliar spray of juice on 25th day	332.15	95.11	160.09	226.05	49.14	414.95
NPK + two foliar spray of juice on 25th, 50th days	307.63	88.44	153.99	263.17	58.20	491.76
NPK + three foliar spray of juice on 25th, 50th and 75th days	275.01	75.72	139.39	341.58	73.24	645.34
One foliar spray of juice alone	253.14	67.68	127.10	304.71	47.88	614.32
S.E. D	6.08	1.623	2.880	6.260	1.816	7.190
CD (P=0.05)	12.77	3.409	6.060	13.120	3.978	14.630

sed concentration of NPK in the rice grain and straw might be due to the favourable effect of lucerne hay when applied to the soil by way of production of different organic compounds like amino acids, growth hormones etc. This in turn might have influenced the microbial activities in the root zone and enhanced the absorption of nutrients. Among the different treatments tried, NPK plus lucerne hay soil applied pots recorded significantly higher concentrations of nutrients in both grain and straw. This could be attributed to the increased availability of NPK in the soil medium and thereby causing higher absorption of nutrients by rice.

Effect on nutrient uptake

Significant differences in the uptake of N, P and K by grain and straw were observed due to the various treatments. The uptake values for NPK (Table III) were higher in all the treatments than control. Among the different treatments tried, the treatment which received NPK + lucerne hay soil application recorded higher nutrient uptake values for grain and straw than the rest. This indicated the favourable influence of the combination of the NPK+soil application of lucerne hay in increasing the nutrient availability and uptake. The favourable influence could be due to the increased

TABLE IV. Influence of treatments on the available nutrient status of the soil
(Mean of three replications) (Kg/ha)

Treatment	Avai- lable N	Avai- lable P	Avai- lable K
Absolute control	213	14	317
Lucerne hay soil application	219	18	319
NPK + lucerne hay soil application	240	22	337
NPK + lucerne hay soil application + one foliar spray of lucerne juice on 25th day	232	23	344
NPK + lucerne hay soli application + two foliar sprays by lucerne juice on 25th and 50th day	235	22	342
NPK + lucerne soil application + three foliar sprays of lucerne i.e., on 25th, 50th and 75th days	236	23	340
NPK + one foliar spray of lucerne juice on 25th day	230	20	338
NPK + two foliar spray of lucerne of juice on 25th day and 50th	232	24	343
NPK + three foliar spray of lucerne of juice on 25th, 50th and 75th days	238	24	342
One foliar spray of juice alone	212	24	316
S.E. of mean difference	0.475	0.181	0.310
C.D. (P=0.05)	0.997	0.380	0.650

microbial activities which in turn facilitated increased availability and enhanced uptake of nutrients by rice. In the case of lucerne juice spray treatments there was increased uptake of nutrients compared to control as well as soil application of lucerne hay. The influence of lucerne juice spray in increasing the nutrient uptake by rice could not be explained in full. However the stimulating action of triacontanol present in the lucerne juice could have had a favourable effect in the absorption of nutrients. This study needs further detailed investigations.

Effect on available nutrient status of the soil

Available N: The available N (Table IV) as estimated by alkaline permanganate method was higher in all the treatments except lucerne juice spray over that of absolute control. Lucerne hay soil applied treatment registered greater amount of available N compared

to control. Among the different treatments tried the available N was higher in the NPK plus lucerne hay soil applied treatment than the rest. Addition of lucerne hay through soil along with NPK fertilizers might have created a favourable condition in the root environment and in turn facilitated higher available N in the soil. Lucerne juice spray did not influence much on the available N status of the soil as could be expected.

Available P: The available P content (Table IV) of soil samples differed significantly among the different treatments tried. All the treatments recorded higher available P in the soil than the control. In the different treatments studied, higher available P was observed under NPK plus three foliar sprays of lucerne juice treatment than the others. This could be ascribed to the enhanced solubilization of P from insoluble forms by the various organic acids produced during the microbial activities near the

rootzone of the plant under the treatment. Moreover healthy and vigorous growth of plant might have secreted root exudates in larger quantities which in turn might have enhanced the biological activities in the rhizosphere region. Increased availability of P under the treatment combination receiving lucerne juice spray confirms the above inference.

Available K: The available K (Table IV) was significantly higher in all the treatments except in lucerne juice spray treatments compared to control. There was higher amount of available K in the treatment where lucerne hay was applied through soil. The reaction products formed by way of application of lucerne hay might have solubilized K from fixed and unavailable form. Among the different treatments tried, available K was higher in the treatment which received NPK plus lucerne hay soil application and one foliar spray of juice. The increased available K in the above treatment might be due to the additive effect of mineral fertilizer interacting with lucerne hay applied through soil. Lucerne juice applied pots did not influence much on the available K status of the soil.

The above experiment clearly showed that the application of lucerne hay through soil significantly increased the

NPK contents in grain and straw as well as their uptake. There was also marked differences in the available nutrient status due to the treatments. In the case of lucerne juice spray treatments the influence was not pronounced much with respect to NPK contents in grain and straw and their availability in the soil. Hence detailed study is needed to investigate the influence of lucerne hay applied through soil as well as juice spray on the growth of plant and nutrient contents. The mechanism of operation of triacontanol, the active ingredient in lucerne in increasing the growth and yield of crops needs further investigation.

REFERENCES

- ANONYMOUS, 1978. New plant growth Pusher. Hindu News paper dated 5.3.1978.
- RIES, S.K., V. WERT, C. C. SWELLEY and R.A. LEAVITT, 1977. Triacontanol. A new naturally occurring plant growth regulator. *Science*, 195 : 1339-41.
- OLSEN, S.R., C.V. COLE, F.S. WATANABE and L.A. DEAN, 1954. Estimation of available P in soils by extraction with sodium bicarbonate. *Circ. U.S. Dept. agric.* 939.
- STANFORD, S. and L. ENGLISH, 1949. Use of flame photometer in rapid soil tests of K and Ca. *Agron. J.* 41 : 446-47.
- SUBBIAH, B.V. and C.L. ASIJA, 1956. A rapid procedure for the estimation of available N in soil. *Curr. Sci.* 25 : 259-60.