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Research Paper

Effect of Stylo *(Stylosanthes Hamata)* Based Horti-Pastoral System on Soil Nutrients Dynamics

Agriculture

KEYWORDS :

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ABSTRACT

An experiment was carried out during kharif and rabi 2010-2011 at the Student's Farm, College of Agriculture, Rajendranagar, Hyderabad on red sandy loam soils to study the nutrient dynamics of stylo in guava based horti-pastoral system. The Farm is geographically situated at an altitude of 542.3 m above mean sea level at 170 19' N latitude and 780 28' E longitude and falls under the Southern Telangana Agro-climatic Zone of Andhra Pradesh. The experiment laid out in a randomized block design with three replications and the treatment consists of three different scarification treatments viz., overnight soaked seeds, mudball technique seeds and hot water treated seeds (80-85oC for 3-5 min) and biofertilizers like Trichoderma enriched FYM @ 5 tonnes ha-1 and Rhizobium application @ 1 Kg/5 Kg seed along with normal dry seed for sole stylo application and their combination consisting of 12 treatments. Among the various treatments line sowing of hot water treated with Trichoderma enriched FYM as intercrop with guava (T11) has significantly recorded highest N, P and K uptake and contributed higher available nutrients in the soil as it was compared from initial nutrient status of the soil.

INTRODUCTION

In India, *Stylosanthes*is *hamata* regarded as the most adaptable species due to intrinsic nature of fast growth, soft stem and leafy in nature. In comparison to all other species introduced in India *Stylosanthes hamata* have been observed highly diversified species for both adaptation and yield production including seed production. Stylo is most important range legume for the humid to semi-arid tropics due to its ability to restore soil fertility (Reddy *et al*., 1989), improves soil physical properties by significantly increasing macropores in soil (Bridge et al., 1983) and provide permanent vegetation cover. Stylosanthes species plays a vital role in the development of wastelands in India and they are being grown as an intercrop with food and fodder crops as pastoral, agro-pastoral and silvipastoral systems to improve the soil fertility and soil conservation and to provide additional forage (Ramesh *et al*., 1997). It is also considered a nurse crop in plantation on degraded lands. Therefore, *Stylosanthes hamata* has been identified as an important component of national programmes under wasteland management.

Arable cropping enterprise in drylands is often unremunerative on account of aberrations of monsoon. The major constraints that limit in crop production in dryland are moisture and nutrient stress. Conservation of soil moisture and improvement of soil fertility through addition of organic materials and by growing leguminous pastures may improve both soil fertility as well as quality fodder requirement to cattle. The total predicted population of livestock in 2007 is 529 .7 million with the annual growth rate 2.23 from 2003-07 and in Andhra Pradesh it was found 60.2 million livestock population in 2007 (18th Livestock Census 2007). With the increase of livestock population forage needs increased many folds. In Andhra Pradesh, the estimate of fodder production from all sources is projected to be 350 m t, as against the requirement of 400 m t for the economic productivity of livestock (Rao 2004). There is tremendous pressure of livestock on available forage resources, as land available for forage production has been static during the last decade around 5 % of the total cultivated area, and there is little scope for increasing the area under forages due to pressure on land for food and commercial crops. This deficit needs to be bridged by maximizing forage production in space and time, integration of forage crops in traditional cropping system, identifying new avenues of forage resources, utilization of marginal and degraded lands for forage production. Hence an integrated approach of land management to utilize the natural resources more efficiently in rainfed areas is essential to meet the requirements of farmer and his livestock without deteriorating his land productivity and generate continuous stable income. One of the need based land use systems replacing the traditional farming system is a tree based system of cropping i.e. Agro forestry (Horti-pastoral system) which acts as sustainable land management system especially in dry land areas.

MATERIALS AND METHODS

The field experiment entitled "Studies on establishment techniques of stylo on *Stylosanthes hamata* in horti-pastoral system" was conducted during *kharif* & *rabi* season, 2010-11 at the Student's Farm, College of Agriculture, Rajendranagar, Hyderabad on red sandy loam soils which is geographically located at an altitude of 542.3 m above mean sea level at $17^0 19'$ N latitude and $78^0 28'$ E longitude and falls under the Southern Telangana Agro-climatic Zone of Andhra Pradesh. The soil of the experimental site was red sandy loam in texture and belongs to order Alfisols, the chemical analysis of the soil sample for experiment revealed that the soils are neutral (pH7.1) with medium in organic carbon (0.52 %), available nitrogen(223.6 kg ha^{-1}), phosphorus (35.4kg ha^{-1}) and potassium (231.8kg ha^{-1}). The recommended dose of fertilizer@ 25:65:35 kg N, P_2O_5 and K_2O ha^{-1}as common dose for all treatments of stylo, 900 : 600 : 600 g NPK per each guava tree and 500 : 300 : 200 g NPK per each curry leaf tree is followed. The experiment was laid out in a randomized block design with three replications and the treatment consists of three different scarification treatments *viz.,* overnight soaked seeds, mudball technique seeds and hot water treated seeds (80-85^{o}C for 3-5 min) and bioagents like *Trichoderma* enriched FYM @ 5 tonnes ha^{-1} and *Rhizobium* application @ 1 Kg/5 Kg seed along with normal dry seed for sole stylo application and their combination consisting of 12 treatments. Broadcasting of dry seed of stylo as sole crop (T_1). Line sowing of dry seed of stylo as sole crop (T_2). Guava + Curry leaf (T_3). Line sowing of stylo with overnight soaked seeds + *Rhizobium* treatment asintercrop in guava (T_4). Line sowing of stylo with overnight soaked seeds + *Trichoderma* treatment as intercrop with guava (T_5). Line sowing of stylo with overnight soaked seeds without *Rhizobium* and *Trichoderma* treatment as intercrop in guava (T_6). Broadcasting of stylo seed with mud ball technique + *Rhzobium* treatment as intercrop in guava (T_7). Broadcasting of stylo seed with mud ball technique + *Trichoderma* treatment as intercrop in guava (T_8). Broadcasting of stylo seed with mud ball technique without *Rhzobium* and *Trichoderma* treatment as intercrop in guava (T_9). Line sowing of hot water treated seeds of stylo with *Rhizobium* treatment as intercrop in guava (T_{10}). Line sowing of hot water treated seeds of stylo with *Trichoderma* treatment as intercrop in guava (T_{11}). Line sowing of hot water treated seeds of stylo without *Rhizobium* and *Trichoderma* treatment as intercrop in guava (T_{12}). The line sowing was done in the solid rows giving a gap of 30 cm between the rows. The scarification treatments were done just one day before sowing, *Trichoderma* enriched FYM is applied just before sowing and *Rhizobium* is applied along with seed on the day of sowing. Stylo (*Stylosanthes* *hamata* cv. verano) is harvested at 90 days after sowing (1st cut) and at 50 days after 1st cut (2nd cut). The guava (cv. Allahabad safed) fruits and curry leaf (cv. Suhasini) harvested once in year. The nutrients like N, P and K uptake by stylo at different growth stages as well as at different cuts and nutrients contributed to soil by this system to soil at end of system were presented.

RESULTS AND DISCUSSION

Line sowing of hot water treated seeds with *Trichoderma* enriched FYM treatment as intercrop with guava (T_{11}) recorded the highest N, P and K uptake (Table 2) at 1st cut (50 kg ha^{-1}, 9 kg ha^{-1} and 45 kg ha^{-1}), 2nd cut (23 kg ha^{-1}, 4 kg ha^{-1} and 20 kg ha^{-1}) and the total uptake (73 kg ha^{-1}, 13 kg ha^{-1} and 65 kg ha^{-1}) followed by line sowing of hot water treated seeds with *Rhizobium* treatment as intercrop with guava (T_{10}) and line sowing of overnight soaked seeds with *Trichoderma* enriched FYM treatment as intercrop with guava (T_5).

Among different scarification treatments, seeds treated with hot water (soaking seeds in hot water for 3-5 min at 80-85 ^oC) were quickly able to break its dormancy and showing better pasture establishment growth resulted in higher uptake. There was increase in the uptake of N, P and K due to application of inorganic fertilizers 100 % (i.e. 25 : 65 : 35 kg N, P and K ha^{-1}) along with application of enriched FYM with bioagents like *Rhizobium*, *Trichoderma viride* (5 tonnes ha^{-1}). These might have provided good nutritive seed bed with organic and inorganic type of nutrition and supplied considerable amount of nutrients to plants compared to other treatments. The nutrient uptake was more in 1st cut than 2nd cut due to application of enriched FYM treatment of bio-fertilizers at the time of sowing also due to excess available soil moisture. These results were in conformity with Sreekala and Jayachandran (2006), Srivastava *et al*. (2008), Reddy and Ahmed (2009) and Yadav *et al*. (2009).

The data related to available nitrogen, phosphorus and potassium in soil (Table 3) after crop harvest was increased with the application of inorganic fertilizers in the form of urea, single super phosphate and murate of potash along with *Trichoderma viride* enriched FYM and seed treated with *Rhyzobium* under guava based horti-pastoral system. The maximum available nitrogen, phosphorus and potassium was recorded under line sowing of hot water treated seeds with *Trichoderma* enriched FYM treatment as intercrop with guava (T_{11}) (262 kg ha^{-1}, 50 kg ha^{-1} and 276 kg ha^{-1} respectively) which was statistically on par with line sowing of hot water treated seeds with *Rhizobium* treatment as intercrop in guava (T_{10}) FYM was good carrier material and the *Trichoderma* enriched FYM reduced the soil borne disease incidence, due to increase in the rhizosphere population of antagonists, and also act as nutritive material to provide a suitable medium for growth of stylo along with increased availability of nutrients.

Table 1. Soil available N, P and K status of the experimental site before sowing

Particulars	Value	Method of analysis
Available nitrogen (kg ha^{-1})	213.6	Alkaline permanganate method (Subbaiah and Asija, 1956)
Available phosphorus (kg P_2O_5 ha^{-1})	32.4	Olsen method (Olsen *et al.* 1954)
Available potassium (kg K_2O ha^{-1})	201.8	Flame photometer method (Jackson, 1967)

Table 2. N, P and K uptake (kg ha^{-1}) by *Stylosanthes hamata* as influenced by different treatments at different cuts

Treatments	Nitrogen uptake (kg ha^{-1})			Phosphorus uptake (kg ha^{-1})			Potassium uptake (kg ha^{-1})		
	At 1st cut	At 2nd cut	Total uptake	At 1st cut	At 2nd cut	Total uptake	At 1st cut	At 2nd cut	Total uptake
T1 - Broadcasting (B.C.) of dry seed of stylo as sole crop.	16	6	22	3	1	4	15	6	21
T2 - Line sowing (L.S.) of dry seed of stylo as sole crop	17	7	23	3	1	5	16	6	22
T3 – Guava + Curry leaf	---	---	---	---	---	---	---	---	---
T4 - L.S. of O .S. Seeds + Rhizobium treatment as I.C.G.	23	6	29	4	2	5	23	8	30
T5 - L.S. of O. S. Seeds + Trichoderma treatment as I.C.G.	33	8	41	6	3	9	30	10	39
T6 - L.S. of O.S. Seeds without Rhizobium &Trichoderma treatment as I.C.G.	19	5	24	3	1	4	18	6	24
T7 - B.C. of seeds with M.B.T. + Rhizobium treatmentas I.C.G.	16	8	24	3	1	4	15	5	20
T8 - B.C. of seeds with M.B.T. + Trichoderma streatmentas I.C.G.	27	10	38	5	2	6	20	7	27
T9 - B.C. of seeds with M.B.T. without Rhizobium &Trichoderma treatmentas I.C.G.	12	5	17	2	1	3	12	4	16
T10 - L. S. of H. W.T seeds + Rhizobium treatment as I.C.G.	43	19	63	8	3	11	39	17	56
T11 - L. S. of H. W. T seeds + Trichoderma treatment as I.C.G.	50	23	73	9	4	13	45	20	65
T12 - L. S. of H. W. T seeds without Rhizobium &Trichoderma treatment as I.C.G.	20	13	33	5	3	8	24	13	37
S.E(m)	1	1	1	0	0	0	1	0	1
CD at 5%	4	2	4	1	0	1	3	1	3
MEAN	25	10	35	5	2	7	23	9	33

NOTE: T3 (guava + curry leaf) was ignored since, it has only sole guava plantation without intercrop while analyzing the data**.**
B.C. = Broadcasting, L.S. = Line sowing, O.S. = Overnight soaked, M.B.T. = Mud ball technique, H.W.T. = Hot water treated, I.C.G. = Inter

crop in guava.

Table 3. Available N, P and K in soil (kg ha^{-1}) after crop harvest as affected by the different treatments

Treatments	Available Nitrogen (kg ha^{-1})	Available phosphorus (kg ha^{-1})	Available potassium (kg ha^{-1})
T1 - Broadcasting (B.C.) of dry seed of stylo as sole crop.	230	37	209
T2 - Line sowing (L.S.) of dry seed of stylo as sole crop	251	47	262
T3 – Guava + Curry leaf	---	---	---
T4 - L.S. of O .S. Seeds + *Rhizobium* treatment as I.C.G.	262	42	267
T5 - L.S. of O. S. Seeds + *Trichoderma* treatment as I.C.G.	255	38	252
T6 - L.S. of O.S. Seeds without *Rhizobium & Trichoderma* treatment as I.C.G.	217	47	261
T7 - B.C. of seeds with M.B.T. + *Rhzobium* treatment as I.C.G.	253	50	232
T8 - B.C. of seeds with M.B.T. + *Trichoderma* treatment as I.C.G.	261	42	233
T9 - B.C. of seeds with M.B.T. without *Rhzobium & Trichoderma* treatment as I.C.G.	248	46	262
T10 - L. S. of H. W.T seeds + *Rhizobium* treatment as I.C.G.	254	43	264
T11 - L. S. of H. W. T seeds + *Trichoderma* treatment as I.C.G.	262	50	276
T12 - L. S. of H. W. T seeds without *Rhizobium & Trichoderma* treatment as I.C.G.	245	39	232
Before cropping of stylo	214	32	202
S.E(m)	8	1	7
CD at 5%	25	4	21
MEAN	249	44	247

NOTE: T3 (guava + curry leaf) was ignored since, it has only sole guava plantation without intercrop while analyzing the data**.**

B.C. = Broadcasting, L.S. = Line sowing, O.S. = Overnight soaked, M.B.T. = Mud ball technique, H.W.T. = Hot water treated, I.C.G. = Inter crop in guava.

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