International Journal of Agriculture Sciences
ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 11, Issue 21, 2019, pp.-9182-9184.
Available online at https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

EFFECT OF NITROGEN SOURCES AND INTERCROPPING OF SWEET SORGHUM ON NODULATION AND GROWTH PARAMETERS OF PHILLIPESARA (*Phaseolus trilobus*)

SINGH SHYAM[1]*, KEWALANAND[2] AND SINGH SANJAY[3]
[1]ICAR-Krishi Vigyan Kendra, Banda, Banda University of Agriculture and Technology, Banda, 210001, Uttar Pradesh, India
[2]Department of Agronomy, College of Agriculture, G. B. Pant University of Agriculture and Technology, Pantnagar, 263153, Uttarakhand, India
[3]ICAR-Krishi Vigyan Kendra, Lakhimpur, C.S.A. University of Agriculture and Technology, Kanpur, 208002, Uttar Pradesh, India, India
*Corresponding Author: Email - shyamsingh15350@gmail.com

Received: October 29, 2019; Revised: November 11, 2019; Accepted: November 12, 2019; Published: November 15, 2019

Abstract: Field experiment was conducted during *Kharif* season of two consecutive years at Instructional Dairy Farm of G.B. Pant University of Agriculture and Technology, Pantnagar to evaluate the nodulation pattern and growth parameters of phillipesara under intercropping with sweet sorghum and different nitrogen sources. The growth parameters viz. plant height, leaf: stem ratio, dry matter accumulation, nodules per plant, and nodule fresh weight of phillipesara increased in both sole and intercropping systems due to application of all integrated sources of nutrients, significantly, higher being with application of nitrogen 50 percent through inorganic source +50 perent through vermicompost. However, all growth parameters except plant height of phillipesara was significantly higher under sole crop compared to its intercropping with sweet sorghum. Intercropping and integrated use of nitrogen produced significantly more nodules count per plant and nodule fresh weight (mg/plant) which results in higher panchang yield of better quality and profitability of farmers.

Keywords: *Phillipesara (Phaseolus trilobus), Intercropping, INM, Nodulation, Sweet sorghum*

Citation: Singh Shyam, *et al*., (2019) Effect of Nitrogen Sources and Intercropping of Sweet Sorghum on Nodulation and Growth Parameters of Phillipesara (*Phaseolus trilobus*). International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 11, Issue 21, pp.- 9182-9184.

Academic Editor / Reviewer: Rajib Das, Herrero B., Darshan Dharajiya, Dr Ajay Haldar, Dr Shubham Lamba, Er Prabhat Kumar Dhara

Introduction

Phillipesara (*Phaseolus trilobus*) is a native of India and growing naturally on the Himalayas. However, it profusely grows in sub-tropical to sub temperate regions of country. Beside its medicinal use it is also grown as a good cover legume and annual forage legume in sub-tropical region of the world. In India its major use is in preparation of Ayurvedic medicines and presently sourced from the natural forests. The roots and whole plant of phillipesara are used as Tridos Shamak against Vat and Pitta generated disorders. As an external use the paste of whole plant and roots are used in pain, wounds and eye disorders. Roots are also used as blood purifier and are main ingredients of chyawanprash. Beside its medicinal value it constitutes a good quality fodder for animals. The growth and feed intake rate reported to increased when phillipesara+cow urin was fed to new born cross bred calves and milk production was also increased when it was fed to milking cows [1]. Application of FYM @ 12.5t/ha+Cow peat@5t/ha+N P K @ 40:30:30 kg/ha has been recommended to enhance dry matter production of *Mucuna pruriens* (L.) D C, a leguminous medicinal plant [2]. Ghosh, *et al*., (2003) [3] has recommended that integrated use of inorganic NPK + FYM or NPK+ poultry manure is an important nutrient management option for sustain in sorghum +Soybean intercropping system, particularly to benefit the legume component.

In spite of its importance as medicinal plant, forage and green manuring crop, it is yet to be domesticated in India. As no information is available about its cultivation technology, especially on nitrogen management for growth, nodulation pattern and production, the present investigation was undertaken to study the nodulation pattern and growth parameters of phillipesara under intercropping with sweet sorghum and different nitrogen sources.

Materials and Methods

The experiment was conducted at Instructional Dairy Farm of G.B. Pant University of Agriculture and Technology, Pantnagar, India, during kharif seasons of two consecutive years. Soil of the experimental field was silty clay loam in texture with pH 7.3 and contained high organic carbon (0.77%), low available nitrogen (280 kg/ha) medium available phosphorus (27.3 kg/ha) and potassium (247 kg/ha). The treatment, three cropping system (sole sweet sorghum, sole phillipesara, sweet sorghum + phillipesara intercropping) and six different sources of nitrogen (100% of recommended N through inorganic source (F1), 75% of recommended N through inorganic sources + 25% through vermicompost (F2), 50% of recommended N through inorganic source + 50% through vermicompost (F3), 75% of recommended N through inorganic source + 25% through FYM (F4), 50% of recommended N through inorganic source + 59% through FYM (F5) and 50% of recommended N through inorganic source + 25% through vermicompost + 25% through FYM(F6) were tested in a randomized block design with 4 replications. Sowing of sole crop of sweet sorghum (variety SSV-84) and phillipesara (variety-Local) was done at a distance of 60 cm (sweet sorghum) and 30 cm (phillipesara), respectively at 3 cm deep, using the recommended seed rate for both the crop (sorghum @ 12 kg/ha and phillipesara @ 10 kg/ha). Thinning was performed 20 days after sowing to keep the plant to plant spacing 15 cm in sweet sorghum and 5 cm in phillipesara. The phillipesara crop was intercropped in between the sweet sorghum rows (1:1) in an additive series, using half seed rate.

The recommended dose of NPK applied to sole sweet sorghum was 120-60-40 kg/ha, sole phillipesara was 25-60-0 kg/ha and for intercropping of sweet sorghum + phillipesara was 80-60-40 kg/ha. Nitrogen was applied through different sources as per treatments. Half of the nitrogen and full dose of P and K was applied at the time of sowing as basal. Rest of the nitrogen was applied in two equal doses each at 30 and 50 days after sowing of sweet sorghum. However, in sole phillipesara, whole amount of N and P was applied as basal.

Table-1 *Growth parameters of phillipesara as influenced by the treatments*

Treatments	Plant height (cm)		Leaf: Stem ratio		Branches per plant		Dry matter (g/sq m)	
	Ist Year	IInd Year	Ist Year	IInd Year	Ist Year	IInd Year	Ist Year	IInd Year
Cropping system								
Sole	138.8	113.0	0.54	0.55	4.90	4.20	320.6	238.4
Intercropping	160.8	120.6	0.44	0.50	3.40	2.90	121.3	92.2
S.Em.±	3.0	1.6	0.01	0.004	0.10	0.06	2.6	1.5
CD at 5%	8.6	4.5	0.04	0.01	0.30	0.18	7.4	4.3
Nsource								
F_1	131.4	94.6	0.41	0.51	3.60	3.10	192.3	135.3
F_2	153.1	118.0	0.45	0.52	4.20	3.60	212.9	163.6
F_3	163.4	128.7	0.57	0.54	4.90	4.00	266.8	215.8
F_4	156.6	120.1	0.48	0.53	4.60	3.90	249.3	184.8
F_5	143.1	112.9	0.44	0.53	3.70	3.30	197.5	145.5
F_6	151.2	116.6	0.49	0.52	4.00	3.40	208.0	147.6
S.Em.±	5.2	2.7	0.02	0.007	0.17	0.10	4.4	2.6
CD at 5%	14.9	7.8	0.06	0.02	0.50	0.30	12.8	7.4

Table-2 *Number and fresh weight of nodules per plant in phillipesara as influenced by the treatments*

Treatment	Nodules count per plant		Nodule fresh weight (mg/plant)	
	Ist Year	IInd Year	Ist Year	IInd Year
Cropping system				
Sole	36.58	35.41	198.00	187.20
Intercropping	25.45	24.37	118.40	114.90
S.Em.±	0.90	1.23	4.50	6.20
CD at 5%	2.59	3.55	12.90	17.80
N source				
F_1	25.25	25.00	116.90	121.50
F_2	31.25	29.25	175.50	167.50
F_3	37.12	35.25	222.30	204.60
F_4	34.12	32.00	176.40	160.5
F_5	29.25	28.25	130.20	121.70
F_6	29.12	29.62	127.60	130.60
S.Em.±	1.56	2.13	7.80	10.70
CD at 5%	4.49	6.15	22.40	30.80

Table-3 *Total productivity and economics as influenced by the treatments*

Treatments	LER		Dry Panchang Equivalent yield(q/ha)			Gross return (Rs/ha)	Cost of cultivation (Rs/ha)	B:C ratio
	Ist Year	IInd Year	Ist Year	IInd Year	Average of two years			
Cropping system								
Sole	1	1	35.4	27.3	31.35	1,56,750	8,806	17.80
Intercropping	1	1	16.9	13.3	15.10	75,500	13,337	5.66
S.Em.±	-	-	0.3	0.3	-	-	-	-
CD at 5%	-	-	0.8	0.8	-	-	-	-
N source								
F_1	1.48	1.50	23.1	16.8	19.95	99,750	10,507	9.49
F_2	1.48	1.46	25.1	20.7	22.90	1,14,500	11,791	8.24
F_3	1.51	1.50	30.9	25.9	28.40	1,42,000	13,076	10.85
F_4	1.46	1.46	29.3	22.2	25.75	1,28,750	11,801	10.91
F_5	1.46	1.51	23.6	17.7	20.65	1,03,250	12,174	8.41
F_6	1.46	1.52	24.8	18.4	21.60	1,08,000	12,659	8.53
S.Em.±	0.03	0.10	0.5	0.5	-	-	-	-
CD at 5%	NS	NS	1.4	1.3	-	-	-	-

Data of LER were analyzed for intercropping system only considering 6 treatments.
LER on the basis of green forage yield of sweet sorghum; Note: Price of phillipesara panchang=Rs. 50/kg and stalk of sweet sorghum=Rs. 50.00/q

Observations for growth studies like plant height, Number of branches per plant, were recorded on randomly selected five plants in net plot area of each plot. From the sampling area sampling was done to study the Stem, Leaf and total biomass weight (fresh and dry), leaf to stem ratio. Total number of nodules was counted from the roots of four sampled plants. At 60 DAS the nodules from the roots of the sampled plants were separated and the weight of nodules was recorded, average weight of nodules per plant was worked out.

Results and Discussion

Growth parameters

Sole cropping of phillipesara and application of nitrogen 50 percent through inorganic source and 50 percent through vermicompost caused significant increase in leaf:stem ratio and dry matter accumulation in leaf, stem including total plant compared to its intercropping and other nitrogen sources during both the years. However, the plant height was increased significantly under intercropping system over sole phillipesara [Table-1]. All the integrated sources caused the significantly higher plant height during second year and more dry matter production during both the years compared to nitrogen applied 100 percent through inorganic source. However, all growth parameters had higher value under integrated sources than 100 percent inorganic source. The higher values of growth parameters under sole crop may be attributed to the increased availability of more light and space compared to its intercropping. The stiff competition for light and space resulted in poor growth parameters like a smaller number of branches, lower leaf: stem ratio and taller plants under intercropping system. These results are in close conformity with the results of Maurya, (2008) [4]. Significant reduction in primary branch per plant and leaf: stem ratio of subabool has been reported earlier by Wani, (1991) [5] when it was intercropped with sorghum. Similarly, higher plant height of intercropped legume crops has also been reported by Singh, (1984) [6], Halikatti (2008) [7] and Brajkishor Prajapati and Kewalanand (2017) [8]. Musa, (1978) [9] was of the opinion that most of the

fixed nitrogen by phillipesara root nodules translocated to leaves and also enhances the availability of phosphorus and trace elements [10]. Thus, better space and availability of input resources may have enhanced these growth parameters. Better availability of nutrients caused by integrated sources of nitrogen promote the luxuriant growth by causing synthesized photosynthate to get metabolitically converted into protein resulting in the production of more vegetative resources which may have been responsible for high dry matter accumulation in various plant parts.

Nodules counts and fresh weight

Cropping system and nitrogen sources significantly influenced the nodules count as well as nodule fresh weight during both the years [Table-2]. Application of nitrogen 50 percent through inorganic fertilizer and 50 percent through vermicompost (F3), being at par with F4 (both the years), F2 and F6 (second year), exhibited significant enhancement in number of nodules per plant compared to remaining sources of nitrogen. However, fresh weight was also significantly higher due to F3 compared to remaining sources of nitrogen during both the years. Application of 100 percent nitrogen through inorganic fertilizer (F1), being at par with F5 and F6 significantly reduced the number and weight of nodules compared to all other nitrogen sources during both the years, except that the nodule number due to F2 during first year was also at par with F1.

Sole cropping of phillipesara caused significant increase in nodules count and fresh weight of nodules per plant compared to its intercropping during both the years. (Table-2). Higher number of nodules per plant in sole cropping of phillipesara may be attributed to better photosynthesis and translocation of photosynthate to root nodules as a result of adequate light and space. These results are in close conformity with the findings of Reddy and Willey, (1980) [11] and Nambiar, (1983) [12] who reported fewer nodules in intercropped groundnut compared to sole.

Total productivity and economics

Intercropping of sweet sorghum and phillipesara caused higher total productivity, expressed by higher Land Equivalent Ratio (LER) irrespective of nitrogen source during both the years [Table-3]. This was because of higher yield of sorghum fodder under intercropping system and some additional yield of phillipesara, but the dry panchang equivalent yield of sole cropping was significantly higher than the intercropping system because of higher economic value of phillipesara panchang (Rs. 50/kg) compared to sweet sorghum fodder (Rs. 50/q). All the integrated sources of nitrogen caused significantly higher panchang equivalent yield compared to inorganic source of nitrogen alone. It might be due to better growth and higher yield of both the component crops under these treatments [13-16]. However, application of nitrogen 50 percent through inorganic + 50 percent through vermicompost, being at par with application of 75 percent N through inorganic + 25 percent N through FYM during first year, caused significantly higher panchang equivalent yield compared to all other sources of nitrogen during both the years. This may also be attributed to better expression of growth parameters, root proliferation, nodulation and dry matter accumulation under this treatment.

Conclusion

On the basis of results obtained it could be recommended that phillipesara should be grown as sole crop with application of nitrogen 50 percent through inorganic source and 50 percent through vermicompost for more and healthy nodules which results in higher panchang yield of better quality and profitability of farmers.

Application of research: Study will help to farmers in getting higher panchang yield of better phillipesara and more profit.

Research Category: Intercropping system

Abbreviations: DAS= Days after sowing,

Acknowledgement / Funding: Authors are thankful to Experimental Station, G.B. Pant University of Agriculture and Technology, Pantnagar, 263153, India.

***Research Guide or Chairperson of research: Dr Kewalanand**
University: G.B. Pant University of Agriculture and Technology, Pantnagar, 263153, Uttarakhand, India
Research project name or number: PhD Thesis,

Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: IDF, Experimental Station, Pantnagar, 263153

Cultivar / Variety / Breed name: Sweet Sorghum-SSV-84; Phillipesara-Local

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

References

[1] Tripathi R. (2006) *Ph.D. Thesis, G.B.P.U.A.&T., Pantnagar*.
[2] Kavitha C. and Vadivel E. (2008) *Legumes Res*., 31(1), 44-47.
[3] 13. Ghosh P.K., Manna M.C., Bandyopadhyay A., Tripathi A.K., Wanjari R.H., Hati K.M., Misra A.K., Acharya C.L. and Rao A.S. (2006) *Agron. J*., 98(4), 1097-1108.
[4] Maurya D.K. (2008) *M.Sc. Thesis, Pantnagar, G.B.P.U.A.&T., Pantnagar.*
[5] Wani A.G., Mahajan V.K. and Umrani N.K. (1991) *Forage Research*, 17(1), 86-88.
[6] Singh V.K. (1984) *M.Sc. Thesis, G.B.P.U.A.&T., Pantnagar*.
[7] Halikatti S.I. (2008) *Ph.D. Thesis, Pantnagar, G.B.P.U.A.&T., Pantnagar.*
[8] Brajkishor Prajapati and Kewalanand (2017) *International Journal of Chemical Studies*, 5(6), 834-838
[9] Musa M.M. (1978) *Legume studies. Annual Report 1970-1971, Gezira Research Station and Substations.*
[10] Abrol I.P. and Palaniappan S.P. (1988) *Green Manuring in Rice Farming*, 71-82.
[11] Reddy M.S. and Willey R.W. (1980) *Field Crop Research*, 4 ,13-24.
[12] Nambiar P.T.C., Reddy M.S., Floyd C.N., Dart P.J. and Willey R.W. (1983) *Exp. Agric*., 19, 79-86.
[13] Niranjan K.P., Gangwar K.S. and Arya R.L. (1998) *In Proceedings of the First International Agronomy Congress, 23-27 Nov., New Delhi*, 431.
[14] Kumar Sudesh and Sharma B.L. (2002) *Forage Res*., 28(3),165-168.
[15] Iqbal Muhammad Aamir, Hamid Abdul, Ahmad Tanvir, Siddiqui Muzammil Hussain, Hussain Imtiaz Ali, Sajid Ali Anser & Ahmad Zahoor (2019) *Bragantia*, 78(1), 82-95.
[16] Molaaldoila Y., Al-Mosanif E., Al-Aqil M., Al-Kumali A. (2017) *Agri Res & Tech, Open Access J*., 3(3), 555614.