Int.J.Curr.Microbiol.App.Sci (2019) *8*(5): 2292-2297

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 8 Number 05 (2019)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2019.805.270

Economics and Yield Performance of Sesbania-Pearlmillet Inter Cropping System under Dryland Conditions of Southern Haryana

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Keywords

Intercropping, Economics, Yield and rain water use efficiency

Article Info

Accepted:
18 April 2019
Available Online:
10 May 2019

A B S T R A C T

A field experiment was conducted during the kharif seasons of 2013, 2014, 2015 and 2016 at the research farm of Dryland Agriculture Research Area of Department of Agronomy, CCS HAU, Hisar. The experiment was conducted with 10 treatments (T1 - Pearlmillet sole at 45 cm, T2 - Sesbania sole at 45 cm, T3 - Sesbania sole at 60 cm, T4 - Sesbania at 90 cm spacing + 1 row of pearlmillet, T5 - Paired row of sesbania at 45:90 + 1 row of pearlmillet, T6 Sesbania at 120 cm spacing + 1 row of pearlmillet, T7 - Sesbania at 120 cm spacing + 2 row of pearlmillet, T8 - Paired row of sesbania at 45:120 + 2 rows of pearlmillet, T9 - Paired row of sesbania at 60 : 120 + 2 rows of pearlmillet and T10- Paired row of sesbania at 60 : 120 + 1 row of pearlmillet) in a Randomized Block Design with three replications. The experiment was failed during kharif 2014 due to low and eratic rainfall in the region. It was observed that intercropping of sesbania in pearlmillet had superior value in respect of the Sesbania grain Yield, pearlmillet grain yield, pearlmillet equivalent yield, net return and B:C ratio among all intercropped treatments. From the pooled data of three years, the highest pearlmillet equivalent yield (17.3 q/ha) was recorded by T7- Sesbania at 120 cm spacing + 2 row of pearlmillet followed by T8 - Paired row of sesbania at 45:20 + 2 rows of pearlmillet. The highest Net return (Rs 5483/ha) and B: C ratio (1.30) was also recorded in T7- Sesbania at 120 cm spacing + 2 row of pearlmillet.

Introduction

In last few decades, rice-wheat cropping system has emerged as a major production system in Haryana. India is now the second largest producer and consumer of wheat in the world. Current agriculture in Haryana is confronted with formidable problems of stagnating production due to decline in factor productivity, degrading soil health, inefficiency of current production practices, scarcity of resources, high cost of cultivation and low returns to the farmers as ill effects of green revolution which concentrates on maximum output but overlooks input use efficiency. Thus recent nutrient-related

stresses are becoming increasingly widespread in many soils due to non-use of organic manures and indiscriminate use of high-analysis fertilizers, leading to decline in organic carbon content of soil and low crop productivity and need to include legumes and green manure crops in cropping systems (Mahapatra *et al.,* 2009). Organic matter is also the principal constituent of soils to support biodiversity and various regulatory processes involved in nutrient transformation and release. Thus to meet out the challenges imposed by overuse of natural resources and climate change in Haryana and to sustain productivity level with optimum use of agricultural inputs, some cropping system, resource conservation, socioeconomic and policy based mitigation and adaptation measures like changing the cropping calendar and improved crop management through inclusion of legume and green manuring crops in crop rotations and intercropping of legumes with cereals/ millets have many potential benefits such as stable yields, better use of resources, weeds, pest and diseases reduction, increased protein content of cereals, reduced nitrogen leaching as compared to sole cropping systems (Venkateswarlu *et al.,* 2009).

Legumes like *Sesbania aculeata* (dhaincha) being quick growing, succulent, easily decomposable, withstands salinity or alkalinity and poor drainage situation better as compared to other green manure crops, is widely used as green manure crop to increase the crop productivity of succeeding crops and to sustain the soil fertility (Das and Sudhishri, 2010). A lot of research work on *Sesbania aculeate* as green manure crop has been done, but very few research findings related to the seed production, agronomy and intercropping under this crop are found in literature. The constraints in the popularization of *Sesbania aculeata* as green manure crop is inadequate availability of quality seeds at reduced cost due to its low seed production and poor economics (Selvi and Kalpana, 2008). Keeping the above facts in view, present investigation was undertaken to enhance the system yield and economics by growing pearlmillet (*Pennisetum glaucum*) as intercrop in seed crop of dhaincha (*Sesbania aculeata*) during *kharif* season.

Materials and Methods

A field experiment was carried out at Research Farm, Dryland Agriculture Unit, CCS Haryana Agricultural University, Hisar, Haryana, India (29º 10′ N latitude, 75º 46′ E longitude and 215.2 M altitude) during *kharif* seasons of 2013 to 2016. The experiment was laid out in randomized block design, replicated thrice with 10 treatments. The total rainfall received during crop seasons were 249.6 mm, 212 mm and 212.8 mm in 2013, 2015 and 2016 respectively. The soil of the field was sandy loam in texture, normal in pH (7.1), low in organic carbon (0.32%), poor in available nitrogen (115 kg/ha), medium in available phosphorus (11 kg/ha) and rich in available potassium (270 kg/ha).The crop was raised with standard package of practices for dryland areas by directorate of extension education, CCS Haryana Agriculture University, Hisar. Sesbania aculiata variety 'DH-1' and 'HHB 67-I' hybrid of pearl millet were used in the study. The crop were sown on 1st July, 2nd July and 12th July during 2013, 2015 and 2016 respectively. The pearlmillet was harvested on 4th October, 14th September and 28th September during 2013, 2015 and 2016 respectively and the sesbania was harvested on 12th September, 14th September and 28th September during 2013, 2015 and 2016 respectively. To record the seed yield of crops it was harvested per plot and converted in to kg/h. The economics of different treatments was calculated by using the data provided by the department of economics, CCS, Haryana Agricultural University, Hisar

and the MSP recommended by the ministry of agriculture, India. The data were pooled of three years and analyzed statistically.

Results and Discussion

Yield

Based on four year study, it is evident from data in Table 1 that Sesbania sole crop planted at 45 cm spacing obtained highest seed yield of 844 kg/ha with non-significant difference over Sesbania sole planted at 60 cm spacing. Among the intercropping systems, highest Sesbania seed yield of 506 kg/ha with a reduction of 40.0 % as compared to sole planted crop was obtain when sown at 90 cm spacing with alternate row of pearlmillet as inter crop. The lowest seed yield was obtained when Sesbania planted at a spacing of 120cm+1 row of pearlmillet spacing with a reduction of 51.1% as compared to sole Sesbania planted at 45cm spacing. Sesbania seed yield was significantly reduced in all the intercropping systems as compared to sole crop of Sesbania. These results are also in agreement with findings of Dhaka *et al.,* (2016) and Pal *et al.,* (2000), that there is significant reduction in seed yield of legume crops under intercropping systems with pearlmillet over sole crop.

The data given in Table 1 reveal that intercropping of pearlmillet in Sesbania reduced the seed yield of pearlmillet significantly in all the treatments as compared to sole crop at a spacing of 45 cm. Among all the intercropping systems highest seed yield with a reduction of 40.9.0% over sole crop was obtained with Sesbania sown at 120 cm spacing+2 row of pearlmillet and it was also significantly higher than all the intercropping systems. These results were in close conformity with findings of Ram *et al.,* (2005) and Dhaka *et al.,* (2016), that the yield of intercropped pearlmillet with legumes reduced significantly over sole crop. Similar trend of observations was found in all the years of study. Among all the intercropping systems maximum pearlmillet equivalent yield of 1730 kg/ha, which was at par with sole crop of pearlmillet at 45 cm spacing was obtained with two row of pearl millet intercropped in Sesbania sown at 120 cm spacing. Similar result of equivalent yield in inter cropped treatment was observed by Padhi *et al.,* (2010).

Economics

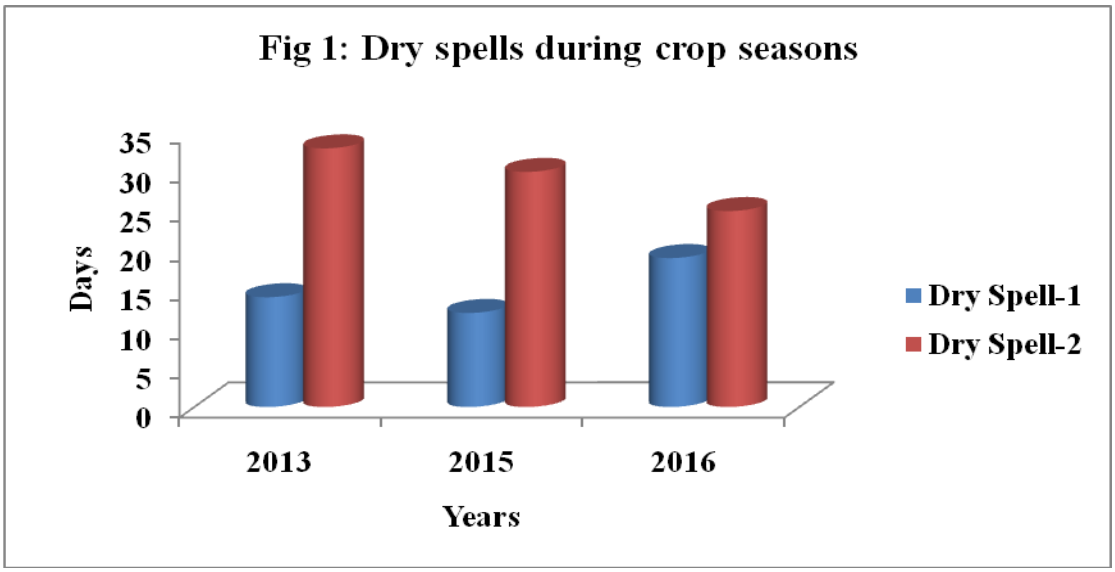
As per the data given in Table 1, The net return return was found maximum when sesbania sown at a spacing of 120 cm and 2 row of pearlmillet in between among all the treatments and it was closely followed by T1 (Pearlmillet sole at 45 cm spacing) and T8 (Paired row of sesbania at 45: 120 + 2 rows of pearlmillet). However the lowest net return was observed in T10 (Paired row of sesbania at 60: 120 + 1 row of pearlmillet). The highest B:C ratio (1.30) was found with Sesbania sown at 120 cm along with 2 row of pearlmillet followed by Paired row of sesbania at 45 : 120 + 2 rows of pearlmillet (1.25) and Pearlmillet sole at 45 cm spacing (1.22). These findings were in accordance with the results of Bhushan and Omprakash, (2001) and Dhaka *et al.,* (2016).

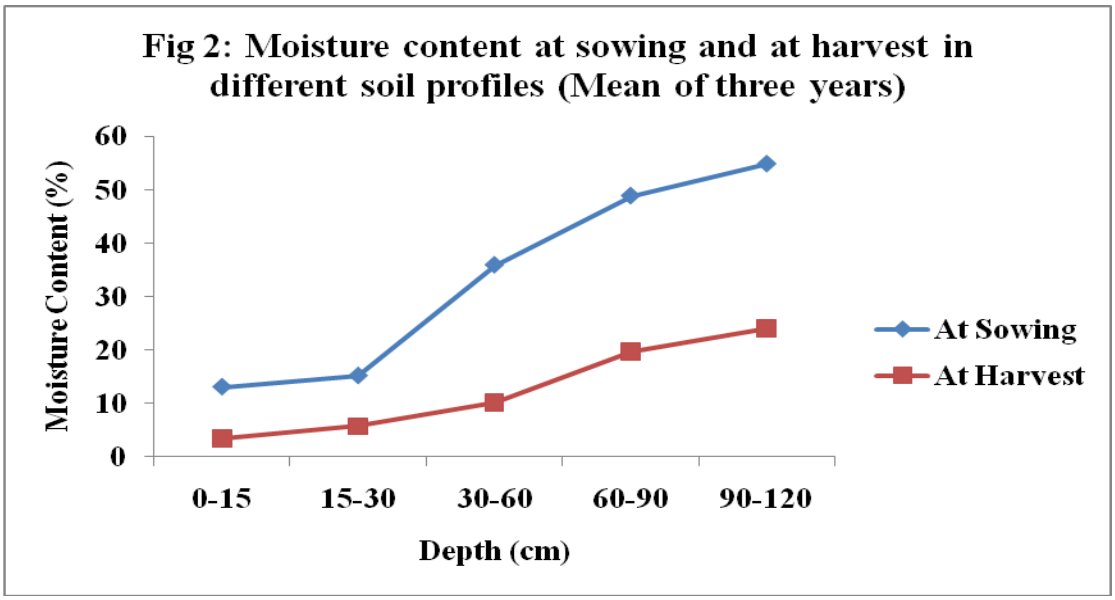
Rain water use efficiency

Among sole crops the highest value (7.88) of rain water use efficiency were observed, however the rain water use efficiency of sesbania sole crop was almost same at both spacing i.e. 45 & 60 cm. The maximum rain water use efficiency (7.69) was recorded in Sesbania at 120 cm spacing + 2 row of pearlmillet closely followed by Paired row of sesbania at 45 : 120 + 2 rows of pearlmillet among all intercropping treatments.

Table.1 Effect of different intercropping system on yield and economic performance of the system (Mean 2013-2016)

Treatments	Yield (q/ha)			Net Return (Rs/ha)	B:C ratio	RWUE (kg/ha/mm)
	Sesbania	Pearlmillet	Pearlmillet eq. yield			
Pearlmillet sole at 45 cm spacing	-	17.6	17.6	4348	1.22	7.88
Sesbania sole at 45 cm spacing	8.49	-	12.4	1251	1.08	5.64
Sesbania sole at 60 cm spacing	8.41	-	12.3	1240	1.04	5.63
Sesbania at 90 cm spacing + 1 row of pearlmillet	5.05	7.91	15.3	2029	1.13	6.84
Paired row of sesbania at 45 : 90 + 1 row of pearlmillet	4.48	6.72	13.4	1940	1.11	5.98
Sesbania at 120 cm spacing + 1 row of pearlmillet	4.16	7.19	13.2	2220	1.14	5.92
Sesbania at 120 cm spacing + 2 row of pearlmillet	4.63	10.45	17.3	5483	1.30	7.69
Paired row of sesbania at 45 : 120 + 2 rows of pearlmillet	4.82	8.64	15.8	4329	1.25	7.07
Paired row of sesbania at 60 : 120 + 2 rows of pearlmillet	4.27	8.19	14.4	2602	1.15	6.44
Paired row of sesbania at 60 : 120 + 1 row of pearlmillet	4.81	5.28	12.5	756	1.04	5.61
CD at 5%	0.61	1.15				





Dry spells

During the crop growing season kharif 2013, there were two dry spells. The first dry spell was of 14 days and second one was of 33 days. Similarly, two dry spells were also observed during 2015 and 2016, and the duration of dry spells were 12, 30 and 19, 25 respectively (Fig. 1).

Moisture content

The data sown in figure 2 revealed that the total soil moisture content of the field at the time of sowing was 168.3 mm/120 cm in soil profile. The moisture content lost through evapotranspiration throughout the crop growing season. At the time of harvesting the total soil moisture content of the field was 63.3 mm/120 cm in the soil profile.

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How to cite this article:

Parvinder Kumar, Mukesh Kumar, Sundeep Kumar, Amit Kumar, Sushil Kumar Singh and Abhineet. 2019. Economics and Yield Performance of Sesbania-Pearlmillet Inter Cropping System under Dryland Conditions of Southern Haryana. *Int.J.Curr.Microbiol.App.Sci.* 8(05): 2292-2297. doi: https://doi.org/10.20546/ijcmas.2019.805.270