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## Performance and evaluation of seed production of green manure crops Sunhemp (*Crotalaria juncea* L.) and Dhaincha (*Sesbania aculeata* L.) in rice fallow situation

Srinivasa Rao MMV, Roy GS, P Seetharamu and K Lakshmana

### Abstract

In agriculture, green manure is created by leaving uprooted or sown crop parts to wither on a field so that they serve as a mulch and soil amendment. The plants used for green manure are often cover crops grown primarily for this purpose. The green manuring is the easiest and cheapest way to enrich the soil fertility besides adding huge amount of organic carbon to the soil and also which prevents soil erosion. The non-availability of green manure seed preceding to paddy is major a constrain at farmers level. In rice fallow pulses the yields are declining due to severe incidence of YMV and farmers are unable reap the pulses in rice fallow situations. Keeping in view of the present scenario in rice fallow pulses, this study on performance of seed production of green manure crops for seed availability and profitability were taken up in farmers fields as On Farm Testing. In the present study the performance of these two crops viz., Sunhemp (*Crotalaria juncea* L.) and Dhaincha (*Sesbania aculeata* L.) were studied for seed yield in rice fallow situation during Rabi, 2015-16 and Rabi, 2016-17 under rainfed ecosystem by DAATT Centre, Vizianagaram District, Acharya N.G. Ranga Agricultural University, in collaboration with Department of Agriculture, Vizianagaram. The On-Farm Trails (OFTs) were conducted at farmers fields in 7 locations randomly covering entire district in Rabi, 2015-16 and Rabi, 2016-17. Observations were recorded on Days to maturity and Seed yield. The results revealed that significantly higher seed yield was observed in Sunhemp when compared to Dhaincha. Seed yield increase was achieved to a tune of 84.00% in Sunhemp crop (1179 kg ha<sup>-1</sup>) over Dhaincha crop (641 kg ha<sup>-1</sup>). The increase in seed yield could be attributed to the performance of Sunhemp crop in-terms of more growth and yield components when compared to Dhaincha crop. The Sunhemp crop matured a week before Dhaincha crop. The farmers realized that, Sunhemp is best suitable green manure crop for seed production in Vizianagaram District of North Coastal Zone, Andhra Pradesh.

**Keywords:** Sunhemp, Dhaincha, rice fallow situation, OFTs and yield

### Introduction

India has changed from a region of food scarcity to food sufficiency by increased fertilizer use with subsidized prices, but use of organic manures including green manure, declined substantially. Inorganic fertilizers are becoming more expensive, therefore sustainability of soil productivity has become a question. Hence, alternate sources to supplement inorganic fertilizers are thought. Green manuring is a low cost and effective technology in minimizing cost of fertilizers, enhance the soil structure and safe guarding the crop productivity. Crops grown for the purpose of restoring or increasing the organic matter content in the soil are called Green manure crops. Use of Green manure crops in cropping system is called 'Green Manuring' where the crop is grown *in situ* or brought from outside and incorporated when it is purposely grown.

Green manure crop should possess the characteristics such as; multipurpose use, short duration, fast growing, high nutrient accumulation ability, tolerance to shade, flood, drought and adverse temperatures, wide ecological adaptability, efficiency in use of water, early onset of biological nitrogen fixation, high Nitrogen accumulation rates, timely release of nutrients, photoperiod insensitivity, high seed production, high seed viability, ease in incorporation, ability to cross-inoculate or responsive to inoculation, pest and disease resistance and high N sink in underground plant parts. In line with these properties, Sunhemp (*Crotalaria juncea* L) and Dhaincha (*Sesbania aculeata* L) are the suitable species for green manuring with high biomass production as 20-25 t/ha (Thipathi *et al.*, 2013) [3].

The lack of availability of adequate quality seed at appropriate time at reasonable price for

small and marginal farmers becomes a major constraint in Sunhemp and Dhaincha cultivation. Quality seed production of Sunhemp and Dhaincha has given meager importance in spite of huge demand from farmers. Further, possibility of seed production under rice fallow situation paves way for identification of suitable crop with high water use efficiency and hence this study was taken up in the farmers fields.

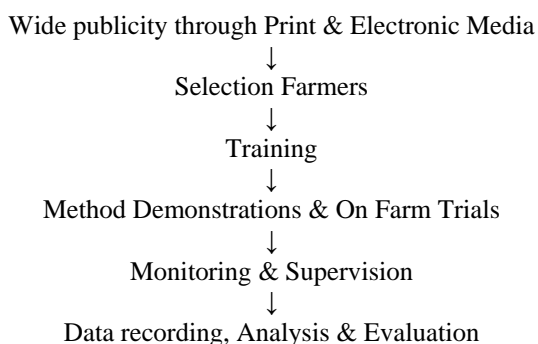
### Objectives

1. To create awareness to farmers on green manure seed production in-situ in rice fallow situation.
2. To evaluate suitable crop of Sunhemp and Dhaincha for seed production
3. To analyze the economics of seed production of green manure crops in Vizianagaram District at farmers level.

### Materials and Methods

Scientists in DAATT Centre, Vizianagaram District, Andhra Pradesh in collaboration with Department of Agriculture, Vizianagaram District has identified the farmers and studied the performance of these Sunhemp and Dhaincha crops sowing in rice fallow situation (Chandrasekhar, 2013)<sup>[2]</sup> by comparing with each other through organizing On-Farm Trials (OFTs) during Rabi,2015-16 and Rabi,2016-17 in 7 locations.

### Flow Chart of Handed Over of Chemical Weed Management in Rice Fallow Blackgram to The Farmers



Farmer fields are selected to conduct On Farm Trials (OFTs) with suitable soils condition with regulation of water. Sunhemp and Dhaincha seeds were broadcasted 7-10 days before the harvest of paddy crop in waxy soil condition in the farmer's fields. Need based plant protection measures were taken up during crop growth period. Observations were recorded on each crop on five randomly selected plants for yield and yield contributing characters viz., days to maturity, plant height (cm), number of branches per plant, number of dry pods, number of seeds/pod, seed yield (kg/ha) and economics. Percentage yield increase in-between crops were calculated and comparative analysis of cost benefit ratio per hectare was arrived and presented in the tables. Simple analysis was done by using Mean only.

### Results and Discussion

The On-Farm Trails on seed production of crops viz., Sunhemp and Dhaincha were conducted in 7 locations across the District in Rabi,2015-16 and Rabi,2016-17 seasons in farmer fields and yield attributes and yield are depicted in following tables. Seed yield is a complex trait, polygenic and highly influenced by environmental conditions. A successful breeding programme depends upon the genetic variability

present among the different genotypes. Phenotypic selection of parents for hybrids based only on their performance alone may not always be available procedure since phenotypically superior genotypes may yield inferior hybrids and/or poor recombinants in the segregating generations. Hence simple analysis on Mean for days to maturity, plant height (cm), number of branches per plant, number of pods per plant, number of seeds/pod, seed yield (kg/ha) and economics was studied in Sunhemp and Dhaincha (Table 1 and 2).

### Plant height (cm)

In Sunhemp, Plant height varied from 115 to 123cm with an overall mean of 119 cm (Table.1). Similarly in Dhaincha Plant height varied from 64 to 94cm with an overall mean of 78 cm observed. While it was found that, Sunhemp crop was 52.56% superiorly taller (119cm) than Dhaincha (78 cm).

### Number of branches per plant

Number of branches varied from 6 to 8 in Sunhemp (Table.1). While in Dhaincha less number of branches per plant observed (4). Results indicated that for any green manure crop more branches per plant may give more biomass, is desirable trait and there is possibility for improvement through selection of this character and breeder may have reliable benefits in next generation with respect to this character. Number of branches are 75.00% more in Sunhemp crop when compared to Dhaincha crop.

### Days to maturity

Maturity duration varies from 115 days to 120 days with a mean of 118 days in Sunhemp (Table.1). Whereas mean number of days taken for maturity in Dhaincha was 122 with range of 120 days to 125 days. Variation in days to maturity provides ample scope for selection of early and late maturing plants for further improvement. Sunhemp crop matures a week early when compared to Dhaincha.

### Number of pods per plant

In Sunhemp, number of pods are ranged from 138 to 162 with mean value of 146 (Table.1). In Sunhemp increased vegetative growth and increased number of branches solely attributed to the increased number of pods. This will have direct selection pressure on yield. Similarly in Dhaincha, number of dry pods varied from 24 to 38 with a mean value of 32 (Venkanna, 2014)<sup>[5]</sup>. Sunhemp having 356.25% more pods production in comparison with Dhaincha crop, this criteria may be useful in selection of green manure crop to take up seed production in rice fallow situation.

### Number of seeds per pod

Average number of seeds per pod in Sunhemp recorded was 12 with a range of 10 to 13 (Table.1). Similarly average number of seeds observed in Dhaincha was 7. Definitely more number of seeds per pod will have positive correlation with seed yield for selection. There is 71.42% more seeds are produced in the pods in Sunhemp crop in comparison with Dhaincha.

### Seed yield (Kg/ha)

Grain yield increase (Table.1) was achieved to a tune of 84.00% in Sunhemp crop (1179 kg/ha<sup>-1</sup>) over Dhaincha (641 kg/ha<sup>-1</sup>). The higher yield in Sunhemp crop in rice fallow situation is contributed by more number of pods and supported by profuse plant growth with more number of branches (Triveni, 2011)<sup>[4]</sup>.

**Table 1:** Mean data on Yield and Yield attributes of On-Farm Demonstrations on Green manure crops seed production conducted Rice fallow situation during Rabi, 2015-16 and Rabi, 2016-17

Sl. No	Name of the farmer and address	Season and year of testing	Plant height		No. of Branches		Days to Maturity		No. of Pods		No. of Seed/Pod		Seed Yield Kg/ha		Percentage Increase in yield of Sunhemp over Dhaincha
			Sunhemp	Dhaincha	Sunhemp	Dhaincha	Sunhemp	Dhaincha	Sunhemp	Dhaincha	Sunhemp	Dhaincha	Sunhemp	Dhaincha	
1	Sri. L. Adinaryana Murthy Vasadi Villlage, Gantyada Mandal	Rabi, 2015-16	123	82	8	3	115	125	142	24	12	8	1250	610	105
2	Sri.S. Ramarao Gollapalle Village, Bobbili Mandal	Rabi, 2015-16	115	78	7	4	120	120	154	36	10	6	1050	670	57
3	Sri. Karaka Srinu Korai Village, Gantyada Mandal	Rabi, 2015-16	118	64	6	5	118	122	162	32	11	7	1150	595	93
4	Sri.B.Gnagaraju Timidi Villlage, S.Kota Mandal	Rabi, 2016-17	120	68	7	4	115	125	124	28	12	8	1150	620	85
5	Sri.S. Ramarao Gollapalle Village, Bobbili Mandal	Rabi, 2016-17	119	72	6	4	120	120	138	34	13	6	1050	670	57
6	Sri.Karaka Srinu Korai Village, Gantyada Mandal	Rabi, 2016-17	120	94	7	4	118	122	148	38	12	9	1250	680	84
7	Sri.R.Rama Krishna V.P.Regai Village, Garividi Mandal	Rabi, 2016-17	115	85	8	3	118	122	152	35	11	7	1350	640	111
		Average	119	78	7	4	118	122	146	32	12	7	1179	641	84
		Percentage improvement		52.56		75.00		4 Days		356.25		71.42		84.00	

### Economics

The cost analysis study revealed that as there is an additional grain yield (Table.2) of 538 Kg/ha<sup>-1</sup> recorded in Sunhemp crop compared Dhaincha crop in rice fallow situation, the rise in yield of Sunhemp in rice fallow situation might be due to the crop contributed with more number of pods and supported by profuse plant growth with more number of branches in rice fallow situation. Additional net income of Rs.22710 ha<sup>-1</sup> received in Sunhemp seed production with additional cost of cultivation of Rs.1500 ha<sup>-1</sup>. It was mainly due to the cost of more harvesting charges due to more Sunhemp crop. It was observed that the cost-benefit ratio was higher in Sunhemp crop (2.54) which is superiorly higher than in Dhaincha crop seed production in rice fallow situation during Rabi season (1.14).

**Table 2:** Economics of the Green manure crops seed production conducted Rice fallow situation during Rabi, 2015-16 and Rabi, 2016-17 seasons

Sl. No	Particulars	Sunhemp	Diancha	Difference
1	Grain Yield Kg/ha	1179	641	538
2	Grain Value (Rs.40/kg)	53055	28845	24210
3	Cost of cultivation Rs./ha	15000	13500	1500
4	Net income Rs./ha	38055	15345	22710
5	C:B ratio	2.54	1.14	1.40

### Conclusions

The overall two consequent years study was revealed that the Sunhemp crop performed better in rice fallow situation in relation to growth and seed yield and it was concluded that Sunhemp crop was ideal to take up green manure seed production during Rabi in rice fallow situation and the same seed may be utilized for green manuring in pre kharif season to enrich the soil fertility at farmers level in the district.

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