

# Influence of Harvesting and Threshing Methods on Seed Quality of Sunn Hemp (*Crotalaria juncea* L.)

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**ABSTRACT:** The present investigation is an attempt to study the effect of different harvesting and threshing methods on germination and seedling vigour of sunn hemp. It was conducted at Agricultural Engineering College and Research Institute, TNAU, Kumulur, Tiruchirappalli, Tamil Nadu during Summer, 2016. The sunn hemp crop was harvested and threshed using four different methods *viz.*, manual harvesting and manual threshing, manual harvesting and mechanical threshing, manual harvesting and tractor treading and harvesting by combine harvester. Studies were also carried out to detect mechanical damage in resultant seeds. Ten days after sowing the harvested seed, the results revealed that the seeds harvested and threshed by manual method maintained 92 per cent germination followed by seeds harvested manually and threshed by tractor treading and combine harvesting (89 per cent). The lowest germination of 83 per cent was recorded by seeds from manual harvest and threshing by mechanical thresher. The physiological parameters of seedling were also on par with germination. From this study, it can be inferred that combine harvester can be recommended for harvesting sunn hemp at 21.5 per cent seed moisture without impairing germination and seedling vigour.

**Key words:** *Crotalaria juncea*, Harvesting and Threshing Methods, Mechanical damage, Germination, Seedling vigour

## INTRODUCTION

Sunn hemp is an important annual green manure legume [1] that produces biomass yield of 15-20 t/ha. It fixes an average of 75-80 kg nitrogen/ha. It is resistant to nematodes [2] and can grow on dry zone soil with low fertility. It acts as field cover which suppresses weeds [3] through smothering effect and conserves soil moisture by reducing evaporation from soil. It promotes biological transformation in soil leading to improved soil structure, fertility and increased crop yields. It is mostly raised for biomass and is normally incorporated into the soil during pre-flowering phase. Hence, there should be enough buffer stock of seed to meet the season-to-season seed requirement. Short fall in quality seed availability is one reason for low utilization of sunn hemp as a green manure [4]. If quality sunn

hemp seed is to reach the farmers, an efficient production system should be adopted to provide the required quantity of quality seed at reasonable price. Efficient seed technological interventions encompassing seed production, processing and storage are essential. But, work on efficient methods of harvest and threshing of sunn hemp seed crop is rather limited. Sunn hemp is harvested as whole plant using sickle and tied as small heaps and carried to the threshing floor. Upon further drying, pods are threshed manually with sticks to dislodge the seeds. In some regions, peduncle (pod stalk) is harvested and collected. This allows the whole plant to be retained in the field and subsequently, be incorporated. This also allows even drying of pods and facilitates further threshing and handling. Manual harvesting is difficult because

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the small hairs on pods, cause irritation when in contact with skin. Since labour cost is increasing, tractor treading may be an effective alternative. Paddy thresher may also be a suitable option as both threshing and pre-cleaning can be done simultaneously. Harvesting sun hemp crop using combine harvester has not been widely attempted and hence merits investigation. Against this background, the study was initiated to assess the effect of different harvesting and threshing methods on germination and seedling vigour in sunn hemp.

## MATERIALS AND METHODS

The sunn hemp crop grown over an area of 1.3ha during Summer 2016 at the Agricultural Engineering College and Research Institute, TNAU, Kumulur, Trichy, was harvested and threshed (with 21.5 per cent seed moisture) using four different methods *viz.*, Manual harvesting and manual threshing ( $T_1$ ), manual harvesting and mechanical threshing ( $T_2$ ), manual harvesting and tractor treading ( $T_3$ ) and harvesting by combine ( $T_4$ ). The threshed seeds, about 8.12q, was sun dried to reduce the moisture content to 12 per cent and processed using cleaner cum grader. Mechanical damage to seed was detected by ferric chloride test [5]. 20% Ferric Chloride ( $FeCl_3$ ) solution was prepared by adding four parts of water to one part  $FeCl_3$ . Five replications of 100 seeds of each treatment were soaked in 20 % solution of  $FeCl_3$  for fifteen minutes. Enough  $FeCl_3$  solution was poured to immerse the seeds in the solution. Separation of black stained seeds was started within five minutes and completed within fifteen minutes after soaking. By counting the number of black stained seeds mechanical damage percentage was recorded.

Germination was tested by roll towel method [6] using 100 seeds in five replications. The experiment was laid in completely randomized block design. Ten days after sowing, per cent germination was computed. Ten seedlings from each replication were randomly taken and root and shoot lengths were measured. The seedlings were then oven dried at 85°C for 24 hours and weighed. Vigour index was calculated using the formula [7] - Vigour Index = Percentage germination x Mean seedling length of ten

seedlings (cm).

The results were subjected to analysis of variance and tested (t-test) for significant difference. Percentage values were transformed into arc sine values prior to analysis [8].

## RESULTS AND DISCUSSION

The results revealed that the influence of different harvesting and threshing methods on germination, root length and seedling vigour was not statistically significant. Seed harvested and threshed by manual method maintained 92 per cent germination followed by seeds harvested manually and threshed by tractor treading and combine harvesting (89 per cent). The lowest germination of 83 per cent was recorded by seeds from manual harvest and threshing by mechanical thresher. The highest shoot length of 15.1cm was by seed from crop harvested by combine harvester followed by manual harvest and mechanical threshing (14.8cm). The shortest shoot length of 13.8cm was from manual harvest and threshing by tractor treading (13.8cm). The highest dry matter production of 0.197 g/seedling was from seeds obtained through manual harvesting and manual threshing followed by combine harvesting (0.182 g/seedling). The lowest dry matter production of 0.167 g/seedling was with manual harvest and threshing by mechanical means (Table 1; Fig. 1).

During manual harvesting/manual threshing and manual harvesting/mechanical threshing, binding of harvested crops into bundles that can be conveniently transported to a threshing location, is a laborious process. Apart from the intensive hand labour, dusty conditions and possible exposure to mold spores, this operation of preparing and carrying bundles is fraught with losses. When bundles are prepared and carried, pods and seeds fall out of the bundles on to the ground creating substantial losses which continue to increase as the plant material dries. Combines provide an enclosed system which greatly reduces the chances of losses and provide a sophisticated cleaning system. Threshing and cleaning operations are complex but combine harvester operates on proven physical principles using impact, acceleration and gravity to thresh,

Table 1. Effect of harvesting and threshing methods on mechanical damage, germination and initial seedling vigour of Sunn hemp

Treatment	Mechanical damage (%)	Germination (%)	Root length (cm)	Shoot length (cm)	Dry matter production (g seedling <sup>-10</sup> )	Vigour Index
T1-Manual harvesting and manual threshing	3.0 (9.98)	92 (73.57)	4.3	14.2	0.197	1692
T2-Manual harvesting and mechanical threshing	4.8 (12.66)	83 (65.65)	4.7	14.8	0.167	1606
T3-Manual harvesting and threshing by tractor treading	4.0 (11.54)	89 (70.63)	4.9	13.8	0.176	1667
T4-Harvesting and threshing by combine	3.8 (11.24)	89 (70.63)	5.3	15.1	0.182	1818
Mean	3.9 (11.39)	88 (69.76)	4.8	14.5	0.181	1696
SEd	0.5831	3.1491	0.5879	0.3845	0.0066	102.8748
CD (P=0.05)	1.2361	NS	NS	0.8377	0.0145	NS

NS-Non Significant

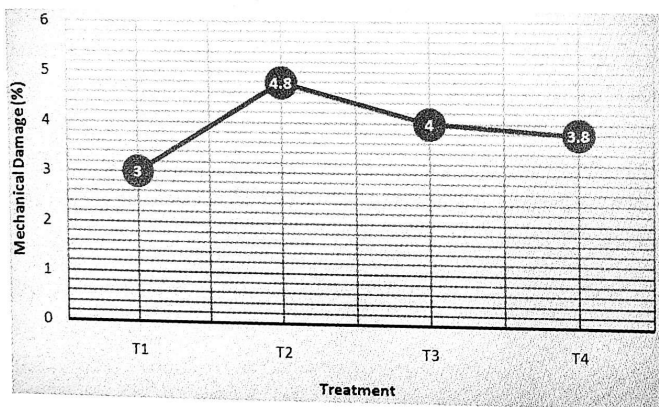


Fig. 1. Effect of harvesting and threshing methods on mechanical damage of Sunn hemp seed

separate and clean seeds. The threshing, separation and cleaning sections of the combine have extremely low losses. If the operator drives slow enough to not slug feed the cylinder/rotor, losses will be low [9]. Since combine harvester is designed for paddy etc, necessary adjustments have to be made to increase the efficiency. When thresher or combine is used, care must be taken to thoroughly check the machinery for previous crop remnants to avoid seed admixture.

The mechanical damage estimated by the ferric chloride test shows minimum damage irrespective of the treatments tried (3 to 4.8%). As sunn hemp seed is uniformly flat with plain surface devoid of projections and has hard seed coat, it escapes from mechanical impact and damage due to different harvesting and threshing methods. Among the harvesting and threshing methods, lowest damage (3.0%) was in the crop harvested and threshed manually, and the highest (4.8%) was in the manual harvest with threshing by mechanical thresher. Manual harvesting and tractor treading recorded 4.0% mechanical damage.

Seeds of *Crotalaria* genotypes were able to initiate germination 25 days after anthesis [DAA] that reached a peak by 40 DAA until natural desiccation led to seeds attaining dormancy. Further, sudden loss in seed moisture enhanced the hard seed content [10]. Freshly harvested sunn hemp seeds possessed 33 per cent hard seeds [11]. Hard testa is responsible for lowering the germination of sunn hemp seeds by slowing down imbibition of water and air. Hard seed content is an advantage for mechanical harvesting

and threshing of sun hemp crop since it leads to lesser mechanical damage. Any hair line crack that occurred during mechanical harvesting and threshing reduces the seed coat dormancy and enhances the germination and seedling growth.

From the results it can be inferred that combine harvester can be recommended for harvesting and threshing sunn hemp seed crop at 21.5 per cent seed moisture content without impairing seed germination and seedling vigour.

#### REFERENCES

1. LATES JC AND BB MABBAYAD (1983). The potential and establishment method of *Crotalaria juncea* L. as a green manure for corn (*Zea mays* L.). *Phillippines Journal of Crop Science* 8: 145-147.
2. MC SORLEY R, DW DICKSON, JA DE BRITO, TE HEWLETT AND JJ FREDERICK (1994). Effects of tropical rotation crops on *Meloidogyne arenaria* population densities and vegetable yields in microplots. *Journal of Nematology*, 26: 175-181.
3. ROTAR PP AND RJ JOY (1983). 'Tropic Sun' sunn hemp (*Crotalaria juncea* L.). Research Extension Series. 36. Hawaii Institute of Tropical Agriculture and Human Resources. University of Hawaii, Honolulu.
4. CHITTAPUR BM AND SS KULKARNI (2003). Effect of sowing dates on the performance of sunnhemp. *Journal of Maharashtra Agricultural University*, 28: 330-31.
5. AGRAWAL RL (1995). Seed viability. *Seed Technology*. 2nd Edition. Oxford and IBH Publishing. Pp 580-582.
6. Central Seed Certification Board (2013). Indian Minimum Seed Certification Standards. Ministry of Agriculture, GOI, New Delhi, pp.183-184.
7. ABDUL BAKI AA AND JD ANDERSON (1973). Vigour determination in Soybean seed by multiple criteria. *Crop Science*, 13: 630-633.
8. PANSE VG AND PV SUKHATME (1995). Statistical methods for agricultural workers. Indian Council of Agricultural Research Publications, New Delhi. 175 p.
9. PAULSEN MR, PK KALITA AND KD RAUSCH (2015). Postharvest losses due to harvesting operations in developing countries: A review. ASABE Annual International Meeting Paper. New Orleans, Louisiana. July 26 – 29, 2015. 34 pp.
10. KHANNA M, AK VARI, S BARANWAL, SP SHARMA AND I JETHANI (2007). Seed maturation and hard seed development in *crotalaria (Crotalaria juncea)*. *Seed Research*. 35: 175-182.
11. RAJENDRA PRASAD S (2014). Effect of mother crop nutrients on seed production and quality in sunn hemp (*Crotalaria juncea* L.) M.Sc (Ag) Thesis. Tamil Nadu Agricultural University, Agricultural College and Research institute, Madurai.