RESEARCH PAPER | International Journal of Agricultural Engineering | Volume 5 | Issue 2 | October, 2012 | 138 –141

Performance evaluation of high capacity sunflower thresher

SHIVANAND H. KAKHANDAKI, M. ANANTACHAR AND M.S. MADHUSUDHAN

Received : 03.04.2012; Revised : 30.06.2012; Accepted : 15.08.2012

See end of the Paper for authors' affiliations

Correspondence to:

SHIVANAND H. KAKHANDAKI
Department of Farm Machinery and Power Engineering, University of Agricultural Sciences, RAICHUR (KARNATAKA) INDIA
Email : shivuagengg@yahoo.co.in

ABSTRACT : Sunflower is one of the main oilseed crop in Northen Karnataka. Shortage of labour demands suitable machinery in this region during threshing operation. Evaluation trials of high capacity sunflower thresher for sunflower crop were carried out. The studies were also conducted for comparing the cost of operation over conventional multi crop thresher. The average value of output capacity, broken grains per cent of the machine was found to be 14.65 kg/mm, 1.84 per cent, respectively as compared to conventional multi crop thresher. Cleaning efficiency and threshing efficiency was more 85 and 98.50 per cent as compared to conventional multi-crop thresher. The performance evaluation trials indicated the suitability of machine for threshing operation in sunflower crop.

KEY WORDS : Multi-crop thresher, Cleaning efficiency, Threshing efficiency

HOW TO CITE THIS PAPER : Kakhandaki, Shivanand H., Anantachar, M. and Madhusudhan, M.S. (2012). Performance evaluation of high capacity sunflower thresher. *Internat. J. Agric. Engg.*, **5**(2) : 138-141.

Oilseed crops occupying an important position in the agricultural economy of any country.In India sunflower is one of the main oilseed crop. Threshing is one of the most crop processing operation to separate the grains from the earheads and prepare the grains for selling. Various types of threshers are available in the market like spike tooth, chaff cutter type, rasp bar type, cylindrical drum with screen type etc. meant for threshing of by hand scraping or beating with sticks and also rubbing two flower heads. Though these methods are safer for seeds development point of view, but they are time consuming and labour intensive job. Such labour intensive post harvest operations not only reduced the profit but also increase the human drudgery. Keeping these factors in a view, an investigation study was under taken to study the performance of high capacity sunflower thresher.

METHODOLOGY

Study was conducted at Department of Farm Machinery and Equipment at College of Agricultural Engineering, Raichur. This place is situated in the North-eastern dry zone (Zone-2, Region-1) of Karnataka state at 160 15' N latitude and 770 20' E longitude at an elevation of 389 m above the mean sea level. The thresher has an axial flow threshing system. In which the material flows parallel to the axis of threshing cylinder. It consisted of a threshing cylinder, concave casing, blower unit and separation unit with thrusts of sieves, outlet for grains, feeding hopper, and transport wheels. The constructional specifications are given in the Table A.

Threshing cylinder:

It was made up of I.S steel of size 2.75x10x6 mm. The cylinder length was 1520 mm which has been divided into portions namely threshing and straw throwing. The threshing portion was one of 1320 mm and the end portion has a length 200 mm of the cylinder. It consisted of spikes

Concave:

It was made up of mild steel sheet molded into U-shape. It has the dimensions as 940-mm width 1320 mm length. The concave has two portions the first portion was of 1120 mm and the end portion of length 200mm the cylinder concave clearance was 40mm and was uniform throughout its length.

Blower unit:

The blower unit was made up of mild steel sheet 10mm thick. The blower unit was of backward curved centrifugal narrow type. It has the dimensions as 1320x940 mm. The bower unit consisted of blower drum and fan blades. There are four blades.

Seperation unit:

The separation unit consisted of three sieves, the sieves were made up of perforated mild steel sheet of 10 mm 5 mm and 2 mm sizes for effective cleaning. The threshed seeds

Table A : Specifications of high capacity of sunflower

Sr. No.	Parameters	Details
1.	Type of machine	High capacity sunflower
2.	Crop	Sunflower
3.	Over all dimensions lxwxh	2030x1960x2140 mm
4.	Weight, kg	730
5.	Power source	35 hp tractor
6.	Threshing cylinder	
	Type	Bar Spike tooth
	Diameter of cylinder mm	770
	Length of spikes mm	60
	Recommended speed, rpm	300-350
7.	Concave	
	Width of concave, mm	940
	Length of concave, mm	1320
	Concave clearance, mm	40
8.	Straw thrower	
	Width, mm	200
	Depth, mm	325
9.	Cleaning system	2 to 3 sieves with a centrifugal blower
10.	Transportation	
	No. and type of wheels	2 pneumatic wheels
	Type of towing arrangement	Draw bar

flows the three sets of sieves and eccentric system is provided for the movement of these sieves.

Out let:

The out for the threshed grains was made at the bottom of sieves. It was made upon mild steel sheet. The outlet was made of rectangular chute shape.

Feeding hopper:

The hopper for the feeding of material to be threshed is provided at the top of the threshing machine, it was made up of mild steel sheet. The dimensions of hopper were 83x45x30 cm.

Transport wheel:

Two number of rubber type (Pneumatic wheels) provided for the transportation of threshing machine was fixed to this framework.

Construction details of multi-crop thresher:

The performance of high capacity sunflower thresher was compared with conventional multi-crop thresher. The construction specification are given in the Table B.

Table B : Specifications of conventional multi-crop thresher

Sr. No.	Parameters	Details
1.	Type of machine	Power operated
2.	Crop	Sunflower and Jowar
3.	Over all dimensions lxwxh	1520x1050x1600 mm
4.	Power source	6 hp diesel engine
5.	Threshing cylinder	
	Type	Spike tooth
	Diameter of cylinder mm	400
	Recommended speed, rpm	400
6.	Hopper dimension	
	Width mm	830
	Length mm	450
	Height mm	300
7.	Cleaning system	3 sieves with a centrifugal blower
8.	Feeding inlet gap mm	221
9.	Transport wheel	2

RESULTS AND DISCUSSION

Pertaining to the experimental investigations carried out under the laboratory conditions following points were discussed, the effect of different operational parameters like output capacity, broken percentage, cleaning efficiency and threshing efficiency for threshing of sunflower and the comparative performance of high capacity sunflower thresher over conventional multi-crop thresher. The results are presented in Table 1 and 2.

Table 1 : Operational parameters on sunflower threshing

Sr. No.	Speed rpm	Concave clearance	Percent broken grains	Cleaning efficiency	Threshing efficiency
1.	380	2.54	2.750	78.870	94.400
		4.00	1.830	83.970	98.495
		5.50	0.000	69.950	96.450
2.	450	2.54	2.780	79.840	97.875
		4.00	1.840	83.680	99.380
		5.50	0.000	68.750	99.500
3.	530	2.54	3.100	78.850	89.545
		4.00	1.860	84.270	99.540
		5.50	0.000	68.670	87.00

Broken percentage:

The analysis in Table 1 and 2 show that the component of grain damage was highest for 2.54 cm clearance followed by 4.0 cm. As the speed increased the percentage of broken grain increased. The relative speeds of drum and clearance showed significant effect on grain breakage, maximum breakage 3.15 per cent was observed in 2.54 cm clearance.

Table 2 : ANOVA table for broken per cent

C_1	C_2	C_3	Mean	SE	C.D. (P=0.05)	C.D. (P=0.01)	Source
2.750	1.830	0.000	1.527	0.007	0.024	0.037	Between two speeds
2.780	1.840	0.000	1.540	0.008	0.023	0.031	Between clearance means
3.100	1.860	0.000	1.653	0.013	0.039	0.054	Between clearance means at same speed
2.877	1.843	0.000	1.573	0.013	0.038	0.052	Between two speeds at the same are difference

Table 3 : ANOVA table for cleaning efficiency

C_1	C_2	C_3	Mean	SE	C.D. (P=0.05)	C.D. (P=0.01)	Source
78.870	83.970	69.950	77.597	0.091	0.314	0.476	Between two speeds
79.840	83.680	68.750	77.423	0.073	0.216	0.296	Between clearance means
78.850	84.270	68.670	77.263	0.126	0.374	0.512	Between clearance means at same speed
79.187	83.973	69.123	77.428	0.137	0.407	0.558	Between two speeds at the same are difference

Table 4 : ANOVA table for threshing efficiency

C_1	C_2	C_3	Mean	SE	C.D. (P=0.05)	C.D. (P=0.01)	Source
94.400	98.495	96.450	96.448	0.281	0.973	1.473	Between two speeds
97.875	99.380	99.500	98.918	0.262	0.779	1.067	Between clearance means
89.545	99.540	87.000	92.028	0.454	1.348	1.848	Between clearance means at same speed
93.940	99.138	94.317	95.788	0.465	1.382	1.893	Between two speeds at the same are difference

Cleaning efficiency:

The analysis Table 1 and 3 showed that the performance of 4.0 cm clearance was better than the other two clearances.

Table 5 : Performance conditions of high capacity sunflower thresher

1.	General	
	Location Test	CAE. Raichur
	Duration of Test	7 hours
2.	**Test condition**	
	Condition of crop	
	Name of crop	Sunflower
	Variety	KBSH-1
	Moisture content of flower	29.1 per cent
	Ratio of weight of flower to seed	1:7
	Prime mover	
	Name of prime mover	35 Hp tractor
	Speed of threshing cylinder	450 rpm
	Speed of blower	1200 rpm
	Speed of sieving mechanism	370 rpm
	Speed of tractor PTO	560 rpm
	Cleaning system	3 sieves with a centrifugal blower
3.	**Performance Test**	
	Actual operating time	7 hours
	Feed rate of crop	7.88 qt/hour
	Output capacity	14.65 kg/min
	Broken grains	1.84 per cent
	Threshing efficiency	98.50 per cent
	Cleaning efficiency	84.00 per cent

The statistical analysis showed significant effect of clearing efficiency at decreased clearance the best results of clearing efficiency 84 per cent were observed at 4 cm concave clearance.

Threshing efficiency:

The analysis of Table 1 and 4 showed that the threshing efficiency was better at 4 cm and 5.5 cm clearance, it was consistent at 4 cm clearance. The interaction of speed and concave clearance showed significant effect. The best result obtained were 98.50 per cent at 4 cm clearance.

The output capacity, cleaning efficiency and threshing efficiency of high capacity sunflower thresher was found maximum *i.e.*, 14.65 kg/min, 85 per cent and 98.50 per cent respectively compared by conventional multi-crop thresher. The broken grain percentage obtained was 1.84 per cent in high capacity sunflower thresher where as it was 2.80 per cent in conventional multi-crop thresher. Narvani (1991) had also conducted the investigations on operational parameters of threshing for sunflower.

Table 6 : Comparative performance of threshers

Sr. No.	Parameters	High capacity sunflower thresher	Conventional multi crop thresher
1.	Output capacity (kg/mm)	14.65	4.10
2.	Broken grains per cent	1.84	2.80
3.	Cleaning efficiency (%)	85	83
4.	Threshing efficiency (%)	98.50	90.15

Authors' affiliations:
M. ANANTACHAR, M.S. MADHUSUDHAN AND ANILKUMAR MANE, Department of Farm Machinery and Power Engineering, University of Agricultural Sciences, RAICHUR (KARNATAKA) INDIA

REFERENCES

Annonyms (2000). A.I.C.R.P report on farm implements and machinery.

Chowdegouda, H. et al. (1981). Machine for threshing safflower current Research (10), U.A.S.Bangalore.

Kamble, H.G. and Panwar, J.S. (1985). Effect of machine crop variables on threshing of pea. *J.Agril Engg. I.S.A.E.*, **20** (4) : 11-14.

Jadhav and Dheshpande (1991). Development and performance evaluation of pedal operated sunflower thresher. *Agril Eng.Today,* **12** (5) : 62-65.

Narvani, N.B. (1991). Studies on design and operational parameters of threshing for sunflower and safflower. Ph.D Thesis, IARI, NEW DELHI (INDIA).

Patel, A.S. et al. (1999). Development of mannual threshing meshes for sunflower. *Agril. Engg. Today,* **24** (6) : 4-8.

Srinivas, Badiger and Bheemashankar (1991). Evaluation of multi crop thresher for safflower.B.tech Thesis, College of Agril. Engg. Raichur, KARNATAKA (INDIA).

Yogeesha, S.C. and Bheemappa, S. (1986). Development of sunflower thresher A Project Report, Agril Engg. Institution,Raichur, Ahmednagar (M.S.) INDIA.

***