ETI ENGINEERING AND TECHNOLOGY IN INDIA
Volume 3 | Issue 2 | October, 2012 | 97-101

RESEARCH ARTICLE

Performance evaluation of threshing of finger millet by traditional method

■ PRASANNAKUMAR AND D.B. NAVEENKUMAR

ABSTRACT : The research was conducted on evaluation and testing of threshing methods for finger millet in the Department of Agricultural Engineering. Finger millet *(Eleusine Coracana* Craertn) commonly known as ragi is one of the important small millet crops grown in red soil areas of India. It is predominantly cultivated in southern parts of Karnataka. The crop occupies an area of 2.5 million hectares and contributes 2.6 million tonnes of grain in India. The process of seed damage starts right from harvest to storage. More mechanical damage occurs during threshing process. The threshing of crop for grain or seed is generally done by manual beating with sticks or passing stone roller drawn by bullock pair or tractor. These traditional methods of threshing are tedious time consuming and inefficient in operation. The experiment was conducted with the varieties of ragi MR1 and HR911, 3 types of traditional threshing methods were adopted, manual beating with the stick, passing a bullock drawn stone roller and passing a tractor drawn stone roller. These three methods of threshing were experimented at three different moisture content levels of ragi [around 18 to 19, 13 to 15 and 10 per cent (w.b.)]. Among three methods of ragi threshing studied, the tractor drawn stone roller method showed higher threshing efficiency of 91.3 per cent for variety MR1 and 86.9 for HR911. The threshing efficiency increased significantly with decrease in moisture content.

KEY WORDS : Finger millet, Stone roller, Threshing, Moisture content, Ragi varieties

Article Chronicle : Received : 22.05.2012**; Revised :** 10.06.2012**; Accepted :** 26.08.2012

How to cite this Article : Prasannakumar and Naveenkumar, D.B. (2012). Performance evaluation of threshing of finger millet by traditional method. *Engg. & Tech. in India,* **3**(2) : 97-101.

INTRODUCTION

Finger millet (*Eleusine coracana* Craertn) commonly known as ragi is one of the important small millet crops grown in red soil areas of India. It is predominantly cultivated in southern parts of Karnataka. The average yield of the crop under rainfed conditions is about 10 q/ha and under irrigated conditions, about 25 q/ha. The crop occupies an area of 2.5 million hectares and contributes 2.6 million tonnes of grain in India. Its cultivation is concentrated mainly in the states of Karnataka (49%), Orissa (11%), Maharastra (10%), Tamil Nadu (9%) and Andhrapradesh (7%), Karnataka stands first both in area (1.06 million ha) and production (1.5 million tonnes). Among all states, Karnataka contributes 54 per cent to country's annual production.

The moisture content of the seeds varies from 10.9 to 40 per cent in a earhead of cereals at harvest time. Ragi can be harvested at 30 days after anthesis. Moisture content of the ear-head plays a key role in threshing operation and seed quality. Processing of ragi has assumed a great importance in the recent years. Therefore, minor injuries to the seeds lead to reduction in normal seedling establishment. The process of seed damage starts right from harvest to storage. More mechanical damage occurs during threshing process. The threshing of crop for grain or seed is generally done by manual beating with sticks or passing stone roller drawn by bullock pair or tractor. These traditional methods of threshing are tedious time consuming and inefficient in operation.

Hence, the present investigation was undertaken at the University of Agricultural Sciences, Gandhi Krishi Vignana Kendra, Bangalore during *Kharif* season to evaluate the various methods of threshing traditionally, to evaluate the threshing methods for ragi, such as manual beating with a stick, bullock drawn stone roller and tractor drawn stone roller, to study the

MEMBERS OF RESEARCH FORUM

Address for correspondence :
PRASANNAKUMAR, Department of Agricultural Engineering, University of Agricultural Sciences, G.K.V.K., BENGALURU, (KARNATAKA) INDIA
Email: prasannakumar555@rediffmail

Coopted Authors :
D.B. NAVEENKUMAR, Department of Agricultural Engineering, University of Agricultural Sciences, G.K.V.K., BENGALURU, (KARNATAKA) INDIA
Email: naveenjrmtech@gmail.com

effect of different parameters on threshing output and efficiency in ragi threshing, to determine the optimum operating parameters to obtain maximum threshing output and efficiency and to work out the cost economics of different methods of threshing at optimum operating conditions.

EXPERIMENTAL PROCEDURE

The experiment was conducted with the varieties of ragi MR1 and HR911, 3 types of traditional threshing methods were adopted, manual beating with the stick, passing a bullock drawn stone roller and passing a tractor drawn stone roller. These three methods of threshing were experimented at three different moisture content levels of ragi [around 18 to 19, 13 to 15 and 10 per cent (w.b.)].

The present study was undertaken at the Regional Research Station, GKVK, UAS, Bangalore. The experiment was conducted with completely randomized block design having methods of threshing as main treatments and moisture content and machine parameters as sub-treatments.

Treatment details :

Threshing methods (T) :

T_1 = Manual beating with stick
T_2 = Bullock drawn stone roller
T_3 = Tractor drawn stone roller

Ragi variety :

Ragi varieties :

V_1 = MR1
V_2 = HR911

Moisture content of grain (M) :

– M_1 = 18 to 19%
– M_1 = 13 to 15%
– M_1 = 9 to 10%

Experimental details :

Threshing methods and manual beating with a stick :

It is a traditional method of ragi threshing in almost all ragi growing areas. This method was evaluated for MR1 and HR911 varieties of ragi and for its output. The crop material used was beaten with a stick. The stick measures about 50cm in length and 4.5cm in diameter (Fig. A).

Procedure :

At a time three middle aged labourers were separately seated and known quantity of crop (about 50kg) was weighed and given to each labour for beating. The starting and closing time were noted. After threshing weight of the threshed grain, unthreshed grain straw and husk were recorded. The procedure was replicated thrice.

Fig. A : Manual beating with a stick

Bullock drawn stone roller :

It is the most popular method followed by majority of farmers. A stone roller, dragged by a pair of bullocks on the spread crop for threshing. The stone roller is made out of granite stone which is easily dragged by a pair of bullocks. Its diameter is 65.85cm and length is 64cm and perimeter is 207cm. It is weighed about 430kgs. The stone roller is provided with an angle iron frame and a wooden beam (Fig. B).

Fig. B : Threshing by bullocks

Tractor drawn stone roller :

The stone roller hitched behind tractor to a hook was passed over the spread crop. This method is a new trend in ragi threshing operation. Here the threshing of ragi is very fast because of the tractor treading and also stone roller rolling over the bed.

In this method the tractor used was Massy Furguson 35hp. The width of rear wheel is 30cm with that of front wheel was 15cm. The total width of the tractor was 165cm. In between two rear wheels the stone roller was rolled. The tractor had diesel consumption of 3.5 to 4.0 litres/hr (Fig. C).

Fig. C : Tractor drawn stone roller

EXPERIMENTAL FINDINGS AND ANALYSIS

The experimental findings of the present study have been discussed in the following sub heads:

Evaluation studies on threshing methods :

Effect of grain moisture content on threshing output of threshed grain in different methods of threshing :

The observations on the output of grain of threshed ragi as influenced by different levels of grain moisture content in different methods are presented in Table 1. The output of threshed grain in manual beating with a stick at grain moisture content of 18.2 per cent for variety MR1 was 4.9kg/h and at 9.8 per cent grain moisture content it was increased to 7.5 kg/h. Similarly for variety HR911 at grain moisture content of 18.9 per cent the grain output of threshed grain was 3.8 kg/h and it increased to 6.0 kg/h when the grain moisture content decreased to 10 per cent.

In case of threshing by bullock drawn stone roller for variety MR1, the maximum grain output was 28.65 kg/h at 15.2 per cent moisture content and at 9.8 per cent moisture content the output was 22.9 kg/h. But for HR911 the maximum output was 25.1 kg/h at 13.4 per cent moisture content and 22.01 kg/h of threshed grain was observed at 18.9 per cent grain moisture content.

In threshing by a tractor drawn stone roller, the maximum output of threshed grain was observed at 18 per cent grain moisture content was 60.9 kg/h and minimum output of threshed grain at 15.2 per cent was 50.63 kg/h for variety MR1. For variety HR 911, the maximum output of threshed grain at 18.9 per cent grain moisture content was 55.98 kg/h and 47.63 kg/h at 13.4per cent grain moisture content.

Effect of grain moisture content on threshing efficiency for different threshing methods :

The observations on the threshing efficiency of ragi is influenced by different levels of grain moisture content of 18.2, 15.2 and 9.8 for variety MR1 and 18.9, 13.4 and 10.l per cent for variety HR911 are presented in Table 2.

Among the bullock drawn stone roller and tractor drawn stone roller, the bullock drawn stone roller had the lowest threshing efficiency. This method recorded maximum threshing efficiency of 73.11 per cent at 9.8 per cent moisture content for variety MR1 and 71.4 per cent at 13.4 per cent grain moisture content for variety HR911. The

Table 1 : Effect of moisture content level of grain on output of threshed ragi (kg/h) for different threshing methods (including winnowing time)

Threshing methods	Out put of threshed grain (kg/h)							
	Variety MR1				Variety HR911			
	Moisture content				Moisture content			
	18.20%	15.20%	9.80%	Mean	18.9%	13.4%	10.1%	Mean
Manual beating with stick	4.99	6.56	7.48	6.34	3.81	5.22	6.00	5.00
Bullock drawn stone roller	25.07	28.65	22.91	25.54	22.01	25.14	22.58	23.24
Tractor drown stone roller	60.93	50.63	56.42	55.99	55.98	47.63	50.63	51.41

Table 2: Effect of moisture content level of grain on threshing efficiency for different threshing methods

Threshing methods	Threshing efficiency (%)							
	Variety MR1				Variety HR911			
	Moisture content				Moisture content			
	18.20%	15.2%	9.80%	Mean	18.9%	13.4%	10.1%	Mean
Manual beating with stick	100	100	100	100	100	100	100	100
Bullock drawn stone roller	64.92	71.0	73.1	69.6	67.8	71.4	67.6	68.9
Tractor drown stone roller	82.3	87.4	91.3	87.0	77.4	83.1	86.9	82.5

lowest threshing efficiency was observed at 18.2 and 10.1 per cent grain moisture content is 70.10per cent and 72.5 per cent, respectively for variety MR1 and HR911. From the threshing efficiency results, it was observed that the grain moisture content played an important role as the grain moisture content of grain decreased, it recorded increased threshing efficiency in all the methods.

Effect of grain moisture on mechanical damage of the threshed ragi grain for different threshing methods :

The mechanical damage was low at higher grain moisture content and it increased with decrease in grain moisture content in methods of threshing. It was found to be maximum 3.67 and 3.9 per cent at 9.8 and 10.1 per cent grain. Moisture content for MR1 and HR91 1 variety Table 3. In tractor drawn stone roller method, the mechanical damage to grain was more as compared to all other methods. Manual beating with a stick, bullock drawn stone roller at all grain moisture levels and in both the varieties.

The mechanical damage was recorded maximum of 3.67 per cent at 9.8 per cent grain moisture content for variety MR1, in tractor drawn stone roller and 3.9 per cent at 10.1 grain moisture content for variety HR911. In tractor drawn stone roller and 3.9 per cent at 10.1 grain moisture content for variety HR911. This damage was reduced to 1.77 and 1.7 per cent at 18.2 and 18.9 per cent grain moisture content for variety MR1 and HR911.

Cost of operation for different threshing methods at different grain moisture content for two varieties of ragi :

The operational cost differed significantly with different methods of threshing at different grain moisture content levels for two varieties of ragi. The operational cost mainly depended on time taken for threshing operation. The operational cost differed significantly with different methods of threshing at different grain moisture content levels for two varieties of ragi Table 4. The cost of operation of manual beating with a stick at 18.2 per cent moisture content for variety MR1 was Rs.90.1/ quintal at 15 per cent grain moisture content it was Rs.70.8 per quintal and further it was recorded to 60.2 per quintal at 9.8 per cent grain moisture content. But in variety HR911 the cost of operation was little higher Rs.118.45, Rs.86.2 and Rs.75/q at 18.9, 13.4 and 10.1 per cent grain moisture content, respectively.

The bullock drawn stone roller, the cost of operation of MR1 threshed at 18.2 per cent grain moisture content was Rs.44.3/q, at 15.2 per cent grain moisture content it was Rs.38.7/ q at 9.8 per cent grain moisture content it was Rs.48.8 per quintal. Whereas in variety HR911 the cost of operation was higher compared to variety MR1, Rs.50.4, 44.2 and 49.1 per quintal threshed at grain moisture content of 18.9, 13.4 and 10.1 per cent, respectively.

Cost of operation in tractor drawn stone roller method for variety MR1 at 18.2 per cent moisture content was Rs. 22.5/q, at 15.2 per cent grain moisture content it was Rs27.1/q and at 9.8 per cent grain moisture content it was 24.4/q. But the cost of operation was little higher in variety HR911. The cost of threshing at 18.9, 13.4 and 10.1 per cent grain moisture content was 24.3, 28.7 and 27.1 per quintal, respectively.

Behera *et al.* (1990) and Desta and Mishra (1990). have also conducted research work related to the present investigation.

Conclusion :

– Among three methods of ragi threshing studied, The tractor drawn stone roller method showed higher threshing

Table 3: Effect of moisture content level of grain on mechanical damage for different threshing methods

Threshing methods	Mechanical damage (%)							
	Variety MR1				Variety HR911			
	Moisture content				Moisture content			
	18.20%	15.20%	9.80%	Mean	18.9%	13.4%	10.1%	Mean
Manual beating with stick	0.13	0.30	0.53	0.32	0.17	0.27	0.60	0.35
Bullock drawn stone roller	01.0	1.77	2.57	1.78	1.00	2.03	2.50	1.84
Tractor drown stone roller	1.77	3.33	3.67	2.92	1.70	3.40	3.90	3.00

Table 4 : Cost of threshing (Rs./q)for different threshing methods at different moisture content level of two varieties of ragi (including winnowing co)

Threshing methods	Cost of operation (Rs./q)							
	Variety MRI				Variety HR911			
	Moisture content				Moisture content			
	18.20%	15.20%	9.80%	Mean	18.9%	13.4%	10.1%	Mean
Manual beating with stick	90.1	70.8	60.2	73.7	118.4	86.2	75.1	93.3
Bullock drown stone roller	44.3	38.7	48.8	43.9	50.4	44.2	49.1	47.9
Tractor drown stone roller	22.5	27.1	24.4	24.7	24.3	28.7	27.1	26.8

efficiency of 91.3 per cent for variety MR1 and 86.9 for HR911. The threshing efficiency increased significantly with decrease in moisture content.

– The tractor drawn stone roller method had shown that the higher mechanical damage of 1.7 to 3.8 per cent among all the threshing methods studied. The least mechanical damage to grain varied between 0.13 and 0.60 which was observed in case of manual beating with a stick. There was no significant difference in mechanical damage to grain between two varieties of ragi MR1 and HR911 in all the methods of threshing. There was increase in mechanical damage to grain, threshed at lower grain moisture content.

– The tractor drawn stone roller showed the least cost for MRI Rs. 22.5 and HR911 Rs.24.3/q for threshing operation compared to other two threshing methods.

There was not much difference in threshing cost between varieties.

REFERENCES

Anonymous (1986). Consolidated Final report 1975-1986 of Operational Research Project on Post harvest Technology (Coimbatore centre): 72-78.

Anonymous (2005 a). PAU Progress Report of AICRP on FIM. Punjab Agricultural University, Ludhiana (PUNJAB) INDIA

Anonymous (2005 b). Empowerment of Farm Women in Agriculture. Final Report of MM NATP-20. College of Home Science, Maharana Pratap University of Agriculture and Technology, Udaipur (RAJASTHAN) INDIA, 63p.

Anonymous (2006). Hand Book of Agriculture (5th Ed.). Directorate of Information and Publications of Agriculture, Indian Council of Agricultural Research (ICAR), NEW DELHI (INDIA) **459**:872-879.

Anonymous (2008b). India. Publication Division, Ministry of Information and Broadcasting, Government of India, NEW DELHI (INDIA).

Beheha, B.K., Dash, S.K. and Das, D.K. (1990). Development and testing of a power operated wheat thresher Agricultural Mechanization in Asia, Africa and Latin America. *AMA,* **21**(4): 15-21.

Chhabra, S.D. and Singh, K.N. (1977). Effect of cylinder speed and peg spacing of axial flow thresher on wheat threshing. *J. Agric. Engg*., **14**:141-144.

Chowdhury, M.H. and Buchele, W.F. (1976). Development of a numerical damage index for critical evaluation of mechanical damage of corn. *Trans. of ASAE,* **19**(3): 428-432.

Chowdhury, M.H. and Buchele, W.F. (1978). The nature of corn kernels damage inflected in the shelling crescent of grain combines. *Trans. The ASAE*, **21**(4): 610 – 614.

Desta, K. and Mishra, T.N.(1990). Development and performance evaluation of a sorghum thresher. Agricultural Mechanization in Asia, Africa and Latin America. *AMA*, **21** (3):33-37.

****