

Spiral grain separator : A post harvest technology in soybean production

■ Rajeshwari Desai and Priya Sajjan

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■ **ABSTRACT :** Soybean is India's one of the fastest growing crops and a significant foreign exchange earner. With a humble start of meager 0.44 million tones production in 1980-81, soybean has become a major export earner today. However, the soya industry of the country is crippled by low yield, limited domestic demand, inadequate irrigation and infrastructure. Apart from these, one of the major problems encountered in soybean production is cleaning/sorting/grading of soybean which is laborious and time consuming. Grading/sorting encourages good quality seeds/grains which eases marketing and fetches more money. With this endeavor, the present investigation was carried out with an objective to carry out field validation of improved agricultural labour saving and cost effective tool viz., spiral grain separator. Three methods of grain cleaning methods were compared with the parameters viz., time and labourers and electricity. The results showed that spiral grain separator is the best as compared to other two methods as on an average 3.5q of grains are cleaned per hour manually with two laborers and without electricity. It is a cost effective, labour, time and drudgery reducing farm tool and leaves the farmer free to get on with other work. Hence, there is a very great scope for spiral grain separator in soybean production which will result in improved economics of farm families.

■ **KEY WORDS:** Post harvest technology, Field validation, Spiral grain separator

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See end of the paper for authors' affiliations

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Rajeshwari Desai

All India Coordinated Research Project- Family Resource Management, Main Agricultural Research Station, University of Agricultural Sciences, Dharwad (Karnataka) India
Email : rajmanohardesaiuas@gmail.com

Agriculture is the backbone of Indian Economy. Agriculture is basically an energy conversion industry. A farm is an energy consumer and a producer, because with the use of the different energy inputs, energy output as a crop production is available. India has a major agribusiness sector, which has achieved remarkable successes over the last three and a half decades. Unprocessed foods are susceptible to spoilage by biochemical processes, microbial attack and infestation. The right post harvest practices such as food

processing techniques play a significant role in reducing spoilage and extending shelf life. Separation removes unwanted materials like straws, chaff, weed seeds, soil particles and rubbish from the grain. It improves grain stability, reduces dockage during milling, gives good quality milled and improves the milling output. It also reduces insects, pests and disease infestation. Removing dockage from grain is a common handling practice Food processing requires clean grains to insure purity. Separation grain for seed also requires considerable

cleaning to insure the highest quality seed (Patil and Bansod, 2014). The separator, which classifies seed according to its shape and rolling ability, spiral separators are commonly used to separate good seed from splits, weed seeds, chaff, hulls, stems, etc. and can be used to separate one kind of seed from another depending on their shape and size. They can be used to clean soybeans, corn, mustard, peas, wheat, coriander, peas, millets, peppercorn and much more (Nagesh and Lakshminarasimhan, 2014).

Operating by gravity, the separator contains a spiral (or spirals) that are fed from a top hopper with an adjustable feed plate. The seed leaving the hopper runs over a cone divider which spreads the seeds evenly onto the inner flights. As material flows down the flights the round seeds will travel at a much faster speed than the non-round material. Their momentum increases until the round seeds run over the edge of the inner flights, drop into the outer flights and discharge through a spout at the bottom of the separator. The non-round materials remain on the small, inner flights and slide down to a separate discharge spout at the bottom. consists of sheet metal strips fitted around a central axis in the form of a spiral. The unit resembles an open screw conveyor standing in a vertical position. The seed is introduced at the top of the inner spiral. Round seeds roll faster down the incline than flat or irregularly shaped seeds, which tend to slide or tumble. The orbit of round seed increases with speed on its flight around the axis, until it rolls over the edge of the inner flight into the outer flight where it is collected separately. The slower moving seed does not build up enough speed to escape from the inner flight. Most spirals have multiple inner flights arranged one above the other to increase the capacity.

Determining the correct spiral separator to be used will depend on the diameter, shape and weight of the material being separated. There is no single size spiral that will separate all types of materials. The degree of pitch and diameter of the inner flights on a spiral will determine the quality of separation. In some applications different types of materials that have similar size and weight may be separated on the same spiral, but the quality of separations may vary. It has long lasting durability as it has heavy-duty construction manufactured with welded galvanized steel to withstand heat and vibration. Stainless steel also available. It is not power operated and requires only two labourers for cleaning and grading of grains.

Agricultural technology is so advanced these days that its hard to assume how people coped with the laborious and time consuming grain cleaning process in the past. The importance of spiral grain separator is that it takes each of the hard work out from the equation. It process a great deal of grains/seed every hour, leaving farmer free to get on with other and also reduce the drudgery. Hence, there is a great scope for spiral grain separator tool which will result in improved economics of farm families.

With this endeavor, the present investigation was carried out with the following objectives.

- To carry out field validation of improved agricultural labour saving and cost effective tool *viz.*, spiral grain separator
- To compare the performance spiral grain separator with existing methods.
- To assess the acceptability of the spiral grain separator.

■ RESEARCH METHODS

The sample size of 100 farm families was selected from nearby villages Dharwad taluk for the study. The information on existing methods of performing grain cleaning activity by farmers/women was collected through PRA technique and a self structured questionnaire. The acceptability of spiral grain separator by the farmers was collected by using five point scale starting from agree to disagree. The parameters *viz.*, number of labourers, time and electricity required were studied to compare the performance of spiral grain separator with existing methods. Further the efficiency of the spiral grain separator was tested with respect to different types of grains/seeds.

■ RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Details of the existing methods of cleaning/ grading of grains:

The survey on existing methods of cleaning/ grading of grains revealed that both winnowing method was used to clean the grains at farm by majority of the farmers (63%) followed by harvesting machine (47%). Sieves were used to clean the grains at household level. About

57 per cent of the respondents did not clean the seeds before marketing (Table 1).

Fields validation of spiral grain separator :

Average of different parameters of seed cleaning/

grading in spiral grain separator are shown in Table 2. The observations showed that the average time taken to clean one quintal soybean in spiral grain separator was only 15 mins. with two labourers. This was probably because of the round shape and smooth surface of soya grains. To

Table 1: Details of the existing methods of cleaning/ grading of grains for household purpose (n=100)		
Particulars	Frequency	Percentage
Methods of cleaning soybean at farm		
Winnowing	63	63.00
Harvesting machine	47	47.00
Methods of cleaning soybean at household level		
Hand cleaning with sieves/ strainer	100	100
Cleaning/ grading of seeds before marketing		
Yes	43	43.00
No	57	57.00

Table 2 : Average of different parameters of seed cleaning/grading in spiral grain separator			
Seed	Quantity (qt)	Time	Labour (no.)
Soybean	1	15:00	02
Green gram	1	17:00	02
Black gram	1	16:00	02
Bengal gram	1	28:08	02
Wheat		Not suitable	

Table 3 : Comparison of different parameters between existing method and spiral grain separator			
Parameters	Existing method (Manual)	Seed cleaning machine	Spiral grain separator
Time (mins/q)	0.20q/hour	400 q/hour	3.5q/hour
Labour (no.)	02	02	02
Electricity	Not required	Required	Not required

Table 4 : F test for time factor between existing method of grain cleaning and spiral grain separator (Quantity: 1qt)				
Seed	Labour (no.)	Time (mins.)		F values
		Existing method	Spiral grain separator	
Soybean	02	246	15:00	F treatment =14.30**
Green gram	02	215	17:00	
Black gram	02	220	16:00	F replication = 1.04 NS
Bengal gram	02	182	28:08	

NS= Non-significant

Table 5: Acceptability of the spiral grain separator by the selected farmers (n=50)					
Particulars	Agree	Partially agree	Neutral	Partially disagree	Disagree
Light in weight	24 (24.00)	76 (76.00)	-	-	-
Durable	80 (80.00)	20 (20.00)	-	-	-
Drudgery reducing	100 (100.00)	-	-	-	-
Only round shaped grains can be cleaned	100 (100.00)	-	-	-	-
Saves time	85 (85.00)	15 (15.00)	-	-	-
Noise pollution	100 (100.00)	-	-	-	-
Expensive and lengthy process to purchase	26 (26.00)	74 (74.00)	-	-	-
Labour saving	98 (98.00)	02 (2.00)	-	-	-
Acceptability of the tool	72 (72.00)	18 (18.00)	-	-	-

(Figures in the parentheses indicate percentage)

clean black gram and green gram, the average time taken was 16 mins. and 17 mins. as the grains are not exactly round in shape. The grains had to be put into the machine 3-4 times to clean completely. It took nearly half an hour (28.08 mins.) to clean bengal gram as the grain has not smooth surface. These results are on par with the results of Dahimiwal *et al.* (2017). He concluded from his study that grain grading and polishing machine reduces time required for grading, dust, contaminations, impurities, and hauling from grains. The spiral grain separator is not suitable to clean wheat because of its' oblong shape. Hence the inference can be drawn that the machine is best suitable to clean round shaped and smooth surface grains.

Comparison of spiral grain separator with other methods:

Three methods of grain cleaning methods were compared with the parameters *viz.*, time and labourers and electricity required (Table 3). The results showed that spiral grain separator is the best as compared to other two methods as on an average 3.5q of grains are cleaned per hour manually with two labourers and without electricity. In seed cleaning machine large quantities of seeds are cleaned in less time (400q/hour) but it requires electricity. Manual grain cleaning method is laborious, tedious and time consuming (0.2 q/hour). Thus use of spiral grain separator reduces the labour and saves time while cleaning and grading the seeds/ grains. This result is on par with the results of Borkar *et al.* (2016).

The F values between the treatments *i.e.*, existing method and spiral grain separator revealed highly significant difference. It shows that the quantity of seeds cleaned by spiral grain separator was comparatively higher than the existing method. Further the results revealed non-significant difference between the replications. The time taken to clean the different grains *viz.*, soybean, green gram, black gram and bengal gram was on an average of 20 minutes.

Accessibility the spiral grain separator by the selected respondents:

The accessibility of the spiral grain separator was assessed by using five pint scale *i.e.* from agree to disagree. The respondents who have undergone the

training were selected to study the accessibility of the tool. Majority of the respondents opined that the tool is light in weight, durable, drudgery reducing, time and labour saving device. Majority of them felt that the tool is inconvenient to use as it is too tall. Along with all these advantages, the respondents expressed major disadvantages of the tool that it can be used to clean only round shape grains and it makes noise while cleaning the grains.

Conclusion:

Agricultural technology is so advanced these days that it's hard to assume how people coped with the process of laborious and time consuming grain cleaning process in the past. The importance of spiral grain separator is that it takes each of the hard work out from the equation. It processes a great deal of grains/ seeds every hour, leaving farmer free to get on with other work. It is a cost effective, labour, time and drudgery reducing farm tool. Hence, there is a very great scope for spiral grain separator in agriculture which will result in improved economics of farm families.

Authors' affiliations:

Priya Sajjan, All India Coordinated Research Project- Family Resource Management, Main Agricultural Research Station, University of Agricultural Sciences, Dharwad (Karnataka) India

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