Journal of Agricultural Engineering
Vol. 37(3) : 21- 26 : July-September, 2000
https://doi.org/10.52151/jae2000373.0933

Shelling characteristics of green pea pods

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ABSTRACT

Investigations were carried out to know the effect of moisture content and pod size on shelling efficiency of the power operated green pea pod shelling machine developed at Jabalpur centre of PHTS. Moisture levels of 68.5 to 75.7% (wb) and 20.8-24.5 mm pod size was found most suitable for each variety of green pea pods. Shelling efficiency of Arkel variety was found best at all the levels of moisture content and pod size. Shelling efficiency decreased with increase in moisture content and decrease in size of pods in all the varieties of pea under study.

Pea (Pisum sativum L) is one of the important legume crop of India. In Madhya Pradesh, Jabalpur division has major share in pea production after gram. Jabalpur division occupies more than 54 per cent of the total pea area under cultivation and produces more than 51 per cent of the total production of Madhya Pradesh. The major pea growing district in MP are Narsinghpur, Mandla, Jabalpur, Raisen, Seoni, Damoh, Sagar, Gwalior, Chhindwara, Bilaspur and Vidisha. In India, Uttar Pradesh, Madhya Pradesh, Punjab, Maharastra, Himanchal Pradesh, Haryana, West Bengal, Rajasthan and Karnataka are the major pea growing states.

Green vegetables are the essential items of our daily food. These vegetables not only increase the taste but they provide protein, salt, mineral, calcium iron, carbohydrate and vitamins, Green peas occupy important place among the vegetables. Manual removal of kernels from green pea pods take lot of time (3-3.5 kg of green peas in one hour (Sharma and Singh, 1988) and it is laborious and tiring job. Therefore, it was felt necessary to develop a suitable power operated green pea pod sheller to meet the requirement of the pea growers. The green pea pod sheller will help in developing a technology for pea processing as a small scale industry. This technology will provide an employment potential and also enhance the income of the farmers growing pea.

Mayor et al. (1999b) developed a mechanical technique for slitting the seed coat of the peas prior to dehydration. As a result of the slitting operation, the rate of drying was increased. The rehydration ratio and rehydration rate were increased and the quality of the rehydrated product was improved. Sharma and Mandhyan (1988) developed a hand operated pea shelling machine. They tried three different surfaces (i) punched tin sheet, (ii) cycle tyre treads and (iii) gunny bag cutting. Out of these surfaces, punched tin sheet gave best shelling efficiency

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of 92.7% and capacity of the machine was found to be 24.8kg/h. Sharma and Singh (1989) reported that the size and bulk density decreased with increase in moisture content, angle of repose increase with moisture content and the shelling efficiency improved with decrease in moisture content. The best result was achieved at 73.6 per cent moisture content (wb) having about 100 per cent kernel recovery and 4 per cent damaged kernels.

The present study deals with the effect of moisture content and pod size on shelling efficiency of pea pods sheller. The investigation was planned with the objectives ;

i. to optimize moisture content of maximum shelling efficiency of the developed machine,
ii to optimize pod size for best shelling efficiency of the sheller, and
iii to find out the effect of pea varieties on shelling efficiency of the machine.

MATERIALS AND METHODS

Experiments on shelling of green pea pods were conducted to test the developed pea pod sheller. Good quality fresh and fully matured three different varieties of pea pods were collected from Horticultural Research Farm, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur.

Experimental designs

The independent variables selected for the present study are given in Table 1 along with their levels. The dependent variables which were measured at the time of experiment were unshelled pods, shelled pods, kernel recovery and damaged kernel recovery.

Experimental set up

The shelling was done with the help of a power operated pea pod sheller developed at Jabalpur centre of Post Harvest Technology Scheme. The sheller consisted of a feeding hopper, roller, concave, frame and a 0.25 hp electric motor (Fig.1). The roller was fixed on a central shaft supported on two bearings that rotates in the concave. The roller and concave assembly was mounted on a frame. The concave consists of galvanized iron sheet punched with holes of 16 mm dia at a centre to centre distance of 26 mm. The pea pods get shelled due to friction between the roller, whose surface is abrasive made of punched sheet and concave and also due to impact developed during the rotation of roller.

Table 1 Independent variables selected for the study and their levels

Varieties	No. of levels	Values
Pea Variety	3	Arkel, Azad P-1 and JP-885
Moisture content of pea pods	5 x 3	Arkel- 79.6, 78.5,77.3,75.7, and 72.7% (wb) Azad P-1- 79.2, 76.2, 74.1, 72.4, and 70.3% (wb) JP-885 77.2, 74.8, 72.9, 70.8 and 68.5% (wb).
Size of pods	4x3	Arkel 24.5, 4.2, 23.9 & 23.6mm AzadP-1 23.8, 21.6, 20.3 and 19.1mm JP-885 20.8,20.2, 19.5 and 18.8mm

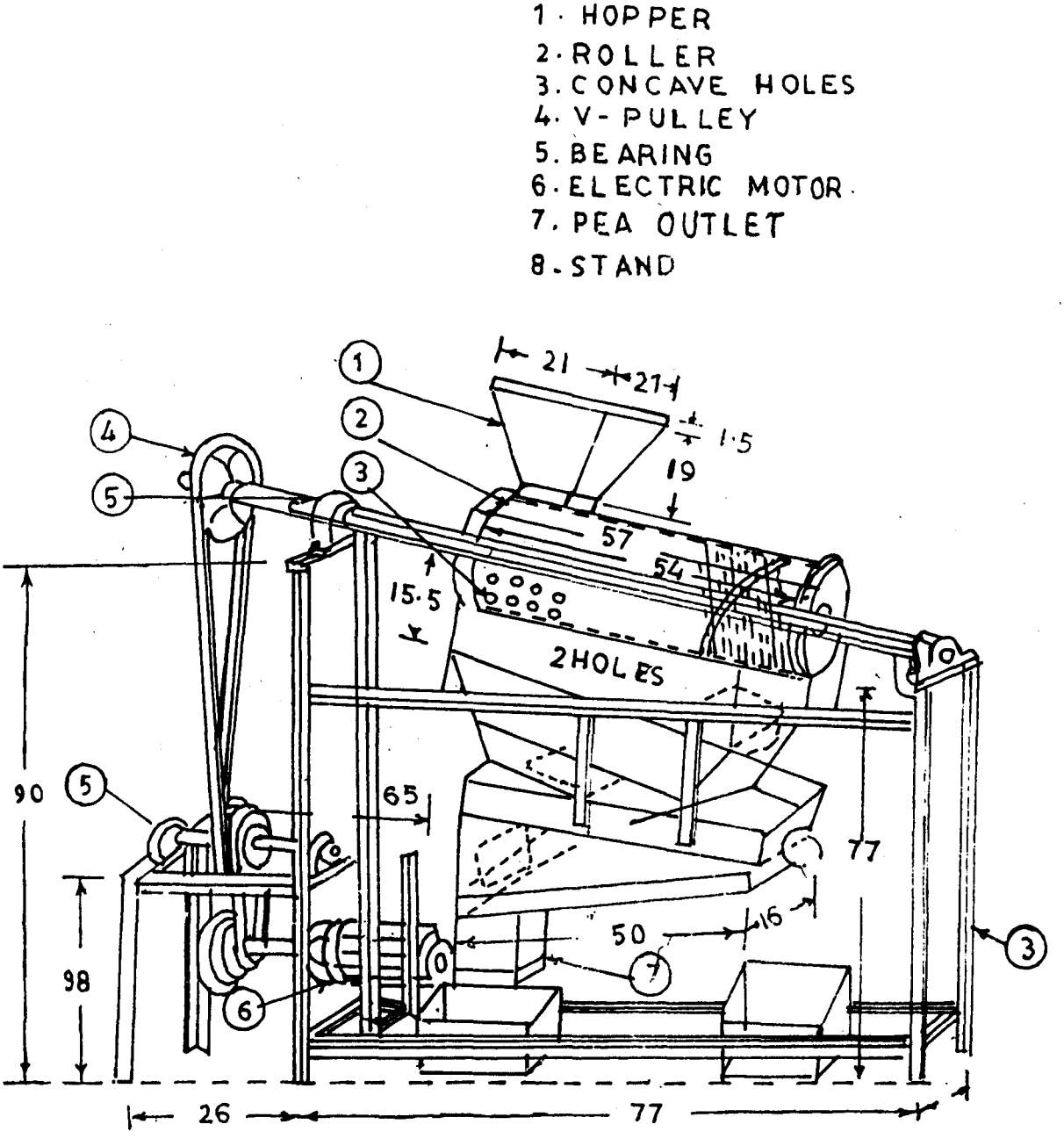

Fig. 1 Power operated green pea pod shelling machine

Experimental procedure

The weighed 5 kg samples of each variety, pod size and moisture content were kept in the polyethylene bags, before start of actual experiments, preliminary trials were conducted and pea pod sheller was cleaned thoroughly. The pods were fed through the hopper for shelling operation. Green pea pods were shelled by uniform feeding at constant speed. The feed rate was controlled by the delivery leaver and clearance was adjusted slightly less than the pod size. Pods with higher moisture content were shelled prior to the pods having lower moisture content. After completion of peeling operation, the machine was stopped and different fractions of the shelled sample like whole kernels, damaged kernels and unshelled pods were collected cautiously. Same procedure was repeated thrice for all the levels of moisture content, pod size and pea variety. The data was presented as moisture content versus shelling efficiency and pod size versus shelling efficiency. The following expressions were used to calculate the shelling coefficient and shelling efficiency (Sharma and Singh 1989).

$$\text{Shelling coefficient,\%} = (1 - \frac{M_{up}}{M_1})$$

$$\text{Shelling efficiency,\%} = (1 - \frac{M_{up}}{M_1}) x (- \frac{M_{dk}}{M_1})$$

where,
M_{up} = mass of unhusked pods, g
M_{dk} = mass of damaged kernels,g
M_1 = total mass of green pea pods before shelling, g

RESULTS AND DISCUSSIONS

Variation of shelling efficiency with different moisture levels

Pod moisture content and shelling efficiency are shown in Fig.2. It can be seen from figure that the performance of Arkel was better than Azad P-1 and JP-885 respectively with maximum shelling efficiency of 97.5% at 72.8% moisture levels. At other moisture levels too, the shelling performance of Arkel was found better than other two varieties considered for the study. It is also clear from figure that the shelling efficiency decreased with increase in moisture levels of pods in all the three varieties.

The equations were developed for curve fitting and correlation coefficient (R^2) calculated in between moisture content and shelling efficiency for each variety of green pea pods. The results are shown below:

Varieties	Equation
Arkel	$Y = 199.04 - 1.39X$, $R^2 = 0.99$
Azad P-1	$Y = 188.70 - 1.32X$, $R^2 = 0.95$
JP – 885	$Y = 171.73 - 1.088X$, $R^2 = 0.99$

The reason for better shelling performance of Arkel may be due to easy removal of thinner shell as well as relatively harder seed which has resulted increase in shelling efficiency.

Variation of shelling efficiency with different pod sizes

Plots of different varieties are drawn between pod sizes and shelling efficiency (Fig.3) which shows that the performance of Arkel variety is better than Azad P-1 and JP-885 respectively with maximum shelling efficiency of 96 per cent at 24.5 mm pod size. For other sizes too the shelling performance of Arkel was found

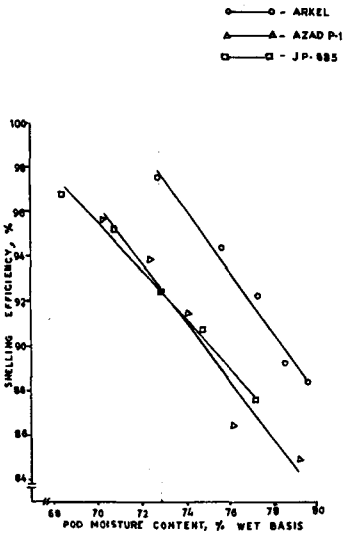

Fig. 2 Influence of pod moisture content on shelling performance of green pea pods

better than Azad P-1 and JP-885. It is also evident from figure that shelling efficiency decreased with decrease in size of pods in all varieties under study.

The regression analysis equations were developed between pod size and shelling efficiency. The results are as follows.

Varieties	Equation
Arkel	$Y = .5.11\ x - 29 - 37,\ R^2 = 0.96$
Azad P-1	$Y = 2.00\ x + 47.5,\ R^2 = 0.87$
JP – 885	$Y = - 6.24\ x - 38.90,\ R^2 = 0.98$

The reason for better shelling performance of Arkel could be because of less number of unshelled pods as well as less damaged kernels in comparison to Azad P-1 and JP-885. Smaller pods also resulted choking which ultimately decreased the shelling efficiency.

CONCLUSION

From the foregoing, it could be concluded that

1. Moisture levels of 68.5, 70.3 and 72.8% wb were found best and suitable for JP-885, Azad P-1 and Arkel variety of green pea pods.
2. Green pea pod sizes of 20.8 and 24.5 mm were observed suitable for JP-885, Azad P-1 and Arkel Variety of green pea pods.
3. From shelling efficiency point of view, Arkel variety was found better (97.5%) than JP-885 (96.8%) and Azad P-1 (95.7%) respectively.
4. Smaller size pods resulted choking and thereby causing reduction in shelling performance.

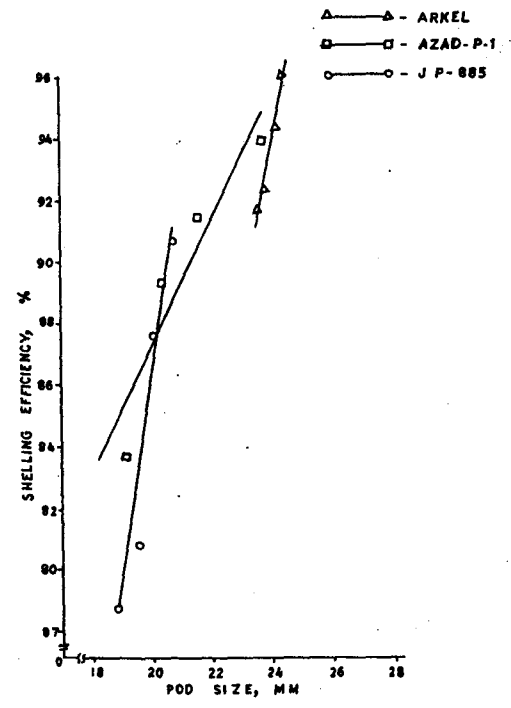

Fig. 3 Influence of pod size on shelling performance of green pea pods

REFERENCES

Mayer JC et al. 1959a. Factors in raw material and processing influencing the reconstitution of dehydrated peas. US. Quarter Master Food and Container Inst. Armed Forces, Contract Res. Project Report V. 308 No.20.

Mayer JC, Pallesan HR and Shallen Berger RS 1959b. The interaction between blanching and drying rates of peas. Food Technology P 581, 583.

Sharma SK and Mandhyan, BL, 1988. Development and evaluation of green pea peeler. Paper presented during the annual meeting of Institution of Engineers, Agricultural Engineering Division, held at Jabalpur on 9th July.

Sharma SK and Singh DS. 1988 and 1989. Design and development and testing of pea shelling machine. Annual Report of AICRP on Post Harvest Technology, Jabalpur Centre.