

## **Portable Walnut Grading Machine Best Replacement for Perforated Cylindrical Grader**

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### **ABSTRACT**

Grading of agricultural produce by mechanical means is of utmost importance for reducing labor cost, processing time and fetching high market value. The perforated revolving cylinders commonly used in walnut processing industries are set useless because of their inefficient grading, high operational cost, tedious operation and occupying large space. The portable low cost high efficient expanding pitch type grader will probably be best replacement for long perforated cylindrical grader.

In view of the importance of grading of fruits, a low cost expanding pitch type fruit grader based on the principle of changing the distance between belts along the length of movement of fruits was developed. The main components of the fruit grader are grading unit, elevator feeding unit, and power transmission system. The elevator feeding hopper is provided for constant and uniform feeding of fruits into the grading unit. Cushioning material has been glued to fruit collection trays and hopper to avoid impact damage and reduce noise at the time of grading. The grader has the provision to separate fruits into four grades by adjusting distance between belts. Testing of the fruit grader showed encouraging results for walnuts and saffron corms. The capacity of the grader was 1400-1600Kgs/hr for walnuts.

**Keywords:** Cracking, expanding pitch, grading, industries.

### **INTRODUCTION**

Grading is basically separating the material in different homogenous groups according to its specific characteristics like size, shape, color and on quality basis. It saves time and energy in different processing operations and reduces the handling losses during the transportation. Normally fruits are graded manually in the country. Manual grading is an expensive and time consuming process and even the operation is affected due to non-availability of labors during peak seasons (Narvankar and Jha, (2005).

Shyam *et al.* (1990) designed and developed a power operated sieve type potato grader that was capable of sorting potatoes into 4 or 5 different sizes or grades. The grader gave high sizing efficiency and 20-25 q h<sup>-1</sup> throughput capacity. The grader employed 10-14 attendants and achieved 80%-90% efficiency with average tuber damage within range of 2%. High labor requirement and re-orientation of the product in sieve opening were considered as problems and a little bit higher skin bruising was observed Patil and Patil (2002) designed, developed and tested performance of sapota fruits grader. The machine developed was of divergent roller type. The effect of roller speed and gap between the rollers on capacity and separation efficiency was also studied. Three rollers speeds (300, 360 and 450 r min<sup>-1</sup>) and three different gap between the rollers (3.0-5.5, 3.3-6.5 and 3.6-7.5 cm) were taken for testing the performance of machine. The maximum capacity of 1,800 kg h<sup>-1</sup> and minimum capacity of 1,152 kg h<sup>-1</sup> were obtained for sapota fruits. The overall machine sorting capacity for sapota was 1,727 kg h<sup>-1</sup>. The maximum and the minimum separation efficiency was 87% and 54%, respectively. The overall separation efficiency of the machine was 72%.

Anonymous (2003) designed and developed a divergent roller type of onion grader Separation of onion is achieved on the basis of size. The roller with spacing of 35-80 mm from feed end to discharge end between the rollers. The spacing between the roller increases feed end to rear end. The onions were graded into four different grades. The capacity of the grader was 500 kg h<sup>-1</sup>. Sized onions passing between the rollers were collected in separate compartment.

Mangaraj *et al.*, (2005) studied on a stepwise expanding pitch fruit grader based on the principle of changing the flap spacing along the length of movement of fruits. The main components of the fruit grader are grading unit, elevator feeding unit, inspection platform and power transmission system. The grading unit consists of two tracks of conveyor chains, matching sprockets, stainless steel flaps, conveyor supporters, flap space adjusting mechanism, power source, power transmission system and fruit collection trays. The elevator feeding unit is provided for constant and uniform feeding of fruits into the grading unit. The Inspection platform is provided for removal of damaged, diseased and unwanted fruits before they are fed to the elevator feeding unit. Cushioning material has been glued to the inspection platform, fruit collection tray and flaps to avoid impact damage at the time of grading. The grader has the provision to separate fruits into four grades by adjusting flap spacing between 45 to 140 mm. Testing of the fruit grader showed overall grading efficiency of 91.50% and 88.50%. For sweet lemon and orange, respectively. The capacity of the grader was 3.5 t h<sup>-1</sup> at grading conveyor speed of 6 m min<sup>-1</sup>.

Ukey and Unde (2010) developed a sapota fruit grader. In order to increase the output of fruit grading and save time and labour, a sapota fruit grader based on divergent roller type principle was designed and developed. The best combination of roller speed, its inclination and roller gap was found to be 223 r min<sup>-1</sup>, 4.5° and 38 to 64 mm, respectively for highest efficiency of 89.5%. The capacity of machine was 1,440 kg h<sup>-1</sup> and costed Rs.11, 450/- (without electric motor).

## RESULTS AND DISCUSSIONS

Grading is the prime concern for any kind of agricultural produce for value addition so as to fetch high market price. At present fruits are mostly graded traditionally/manually because of low adaptability of high priced developed graders. Walnut growers usually dehull their walnuts by hands and sometimes by feet; this process not only injures their hands and feet but also causes many skin diseases and damages their clothes as well by unusual stains. After this complicated processing they sell ungraded walnut stones to whole sale dealers or to walnut processing industries. Although low cost walnut dehullers are already available but most growers are unaware or don't have access to those machines. Grading of walnut stones can increase selling price of walnuts leading a marginal common grower to profitable trade. The traditional grading is not only inefficient but is also labor intensive and time consuming. The perforated cylindrical grader faces overlapping of walnuts as a result reduces its efficiency and these graders are not affordable by a marginal farmer because of high price and operational cost and consuming large space. Mir *et al.*, (2015) developed a portable multipurpose low cost Walnut and Saffron Corm grader at Division of Agricultural Engineering, SKUAST-K, Shalimar and seems to be a best alternative for marginal and progressive farmers and to the Walnut processing Industrialists. This machine has been appreciated by many growers and Industrialists. The mechanism of developed grading machine is given in next section. The test run of the machine showed efficiency of 85-92% on an average and the processing capacity was calculated to be as 1400 to 1600 Kgs per hour, which may increase further depending upon the training of the operator with the machine. The simulation result obtained by using Mamdani inference engine shows that efficiency and benefit is high as compared to its price.

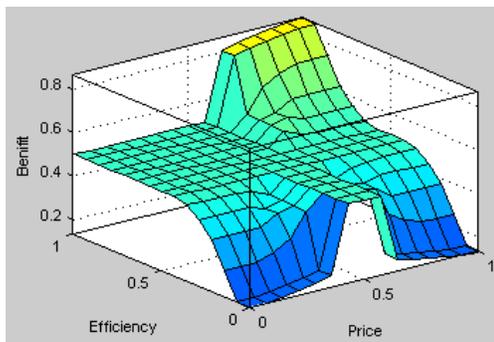


Figure 2 Price, Efficiency Vrs Benefit

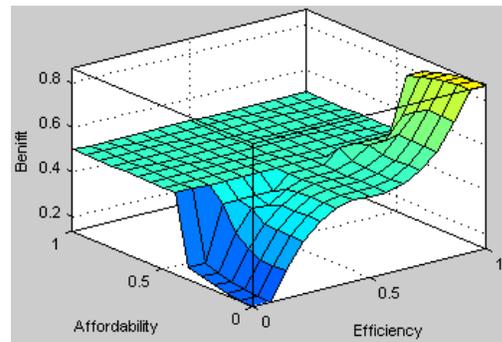


Figure 3 Affordability, Efficiency Vrs Benefit

### Grading Machine

The machine was developed with the aim to benefit marginal farming community for their economical upliftment. The machine uses expanding pitch type mechanism for grading purpose, where seven cylindrical belts moving over 21 pulleys mounted on three shafts are used. The linear speed of belts has been used as 0.75 m/s for best grading. The gap between

belts on feeding side of machine has been set at 26 mm and at the other side has been set at 38 mm. this gap can be changed to any value depending upon grading material, which makes this machine as versatile for multiple purpose grading. The gap can be set by Verner caliper and loosening and fastening pulleys can be done by Allen keys. The frame on which grading system is mounted is 4 feet in length, 2 feet in breadth and three feet in height. An induction motor is used to drive the system for needful grading. Four collecting channels are used for collecting four grades of the material. The collecting channels are lined with soft thermocol and ragzene to prevent injury to soft material and to avoid noise due to flow of fruit.



**Figure 1 Expanding pitch type grading machine**

## **CONCLUSION**

Grading of walnuts is surely a profitable trade and since the procurement of machine is a onetime affair and its benefits are high so it is better that a walnut grower should have this machine. The cost price of this machine can be obtained from one season only even in half the season in case of marginal farmer. Government of Jammu and Kashmir should facilitate farming community through trainings about latest techniques for processing their agricultural produce in general and Walnuts in particular for maximum throughput, so that new generation is also attracted towards this profitable trade. Quality control processing is needed for encouraging the export to fetch more revenue.

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