American Journal Of Applied Science And Technology
(ISSN – 2771-2745)
VOLUME 04 ISSUE 06 Pages: 71-75
OCLC – 1121105677

Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ajast

Copyright: Original content from this work may be used under the terms of the creative commons attributes 4.0 licence.

Research Article

DETERMINING THE CUTTING RESISTANCE OF MUNG BEAN ROOT

Submission Date: June 20, 2024, Accepted Date: June 25, 2024,
Published Date: June 30, 2024
Crossref doi: https://doi.org/10.37547/ajast/Volume04Issue06-14

Astanakulov Komil
Doctor Of Technical Sciences, Professor «Tashkent Institute Of Irrigation And Agricultural Mechanization Engineers» National Research University, 100000 Tashkent, Uzbekistan

Turdibekov Ilkhomjon
Doctoral Student, «Tashkent Institute Of Irrigation And Agricultural Mechanization Engineers» National Research University, 100000 Tashkent, Uzbekistan

ABSTRACT

In this article, the shearing resistance of the arrowroot, which is one of the main parameters for harvesting mung bean crops grown on irrigated land, was studied.

KEYWORDS

Mung bean, arrow root, cutting, soil, depth, pendulum device, power.

INTRODUCTION

In recent years, the concept of food security has been repeatedly recalled worldwide, therefore, attention has been paid to quick-ripening, drought-resistant crops in the agriculture of our Republic. The most common of these is the leguminous mung bean plant, which is mainly grown as a repeat crop in the place of grain crops. According to the estimate of 2023, 300,000 hectares of land freed from grain were planted with mung bean. Mung bean is a leguminous crop with high nutritional value. Digestibility of the contained protein reaches 86%. Mung bean grain contains protein 24-28%, lysine 8%, arginine 7%. Buckwheat grain is 1.5-2 times higher than wheat and rye grains in terms of nutritional value, and 1.5 times higher in nutritional value.

RESEARCH AND RESULTS

The cutting resistance of the arrow root of mung bean crop was determined using a pendulum cutting device. Pendulum cutting device consists of a bottom vertical column and horizontal axes.

In order to determine the force of cutting the root of the mung bean plant, an indicator scale and an arrow are installed around the rotation axis of the device, and a cutting blade is attached to the side of the connecting rod. The needle is additionally equipped with holders holding the root of the arrow in the way of its vibration circle.

The pendulum consists of a connecting rod, a sector, an arrow and blades. Clamps and reverse shear plates were placed to fix the test specimen of the mung bean arrowroot. Experiments were carried out by setting the cutting (setting) angle of the knife to γ = 15°, 30°, 45°, 60° and 75° using the sector.

The other dimensions of the blade are unchanged, its cutting edge thickness is 0.8 mm, the sharpening angle is 15°, and the distance between the blade and the reverse cutting plates is set to 1-1.5 mm. In this case, the thickness of mung bean arrow roots was 4-5 mm on average. After determining that the acceptable cutting angle is 40°, experiments were conducted with arrowroots of different thicknesses at this cutting angle.

Before carrying out the experiments, the weight of the pendulum was selected using bolts and nuts of the lower head of the connecting rod, which were used as an additional load, so that the pendulum would rise to 70°-90° when the pendulum was only moving, and in the working state, it would rise to 25°-35° after cutting the root. has been achieved. The mass of the pendulum was weighed vertically on a technical scale with an accuracy of 5 g. The center of gravity of the pendulum was determined by determining its equal weight on the knife blade in a horizontal position. The distance from the cutting center to the center of gravity was measured using a ruler with an accuracy of 1 mm. After the pendulum was installed in place, it was checked for vibration errors. For this, the pendulum was tried to move 10 times. The angle at which the pendulum should rise should be close to its angle of free movement. The average difference did not exceed 2 percent in the experiments of salt movement.

The cutting quality of mung bean crop was evaluated by its complete and comparative work and cutting force. The complete work of cutting the root of a mung bean crop was determined by the following expression:

$$A = Q \cdot r_B \left(\cos\gamma_1 - \cos\gamma_2 \right) \qquad (1)$$

here – the mass of the pendulum;

r_B – radius of the center of gravity;

γ_1 – working angle of the pendulum;

γ_2 – angle of vertical rise of the pendulum.

The comparative work of mung bean arrow root cutting was determined by the following expression:

$$A_{sol} = \frac{A}{S_\kappa}; \qquad S_\kappa = \frac{\pi \cdot d_\kappa}{4}, \qquad (2)$$

here S_κ – cutting surface;

d_κ – root thickness

The shear strength of the arrow root was determined by the following expression:

$$P_{kes} = \frac{A}{S} \qquad (3)$$

here S – the distance of movement of the knife blade in the working condition, m;

In working condition, the blade travel distance (S) is how far the blade is raised after cutting the root of the arrowroot.

American Journal Of Applied Science And Technology
(ISSN – 2771-2745)
VOLUME 04 ISSUE 06 Pages: 71-75
OCLC – 1121105677
Publisher: Oscar Publishing Services

$$S = \frac{d_{\kappa}}{\cos\gamma} \quad (4)$$

here γ – cutting (installation) angle of the blade, degrees;

The cutting (setting) angle of the knife blade was fixed by setting the position of the knife in the pendulum at different angles. Based on the results of the experiment, it was found that the relative work of cutting the mung bean arrow root changes depending on the cutting angle (Fig. 1).

This graph has the appearance of a parabola, and by analyzing it, the following conclusion can be drawn: when the knife blade is installed at an angle of 15°, the specific work was 5.7 kJ/m2. When the cutting angle changed from 15° to 30°, the specific work decreased by 1.2 kJ/m2 to 4.5 kJ/ m2, and the average value of the specific work in cutting was 0.08 kJ/ m2 per 1° cutting angle. found to be correct. When the cutting angle was increased from 30° to 45°, the relative work in cutting did not change much. As the cutting angle increases from 45°, it was found that the specific work in cutting increases slowly at first and then sharply.

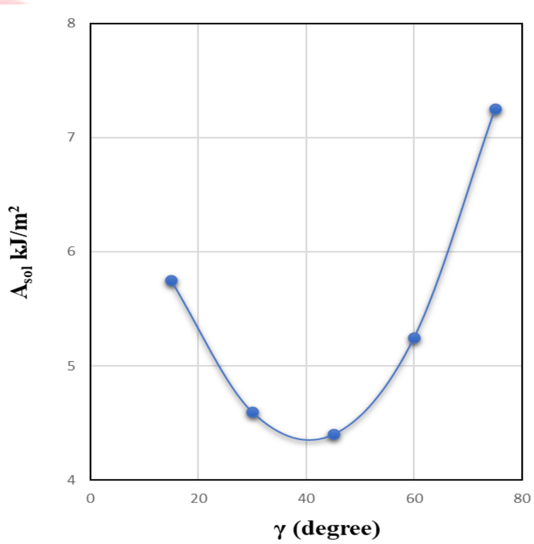

Fig 1. Dependence of the comparative work in cutting the mung bean arrow root on the cutting angle

When the cutting angle was set to 60°, the specific work in cutting was 5.5 kJ/m2, and when the cutting angle was 75°, the specific work in cutting was 7.3 kJ/ m2. When the cutting angle varies from 45° to 60°, it was determined that the specific work of cutting corresponds to 0.06 kJ/ m2 for every 1° cutting angle. When the shear angle varied from 60° to 75°, the equivalent work in shear was 0.053 kJ/ m2 per 1°.

There is a relationship between the shearing strength of the mosh shoot root and its thickness, and the empirical equation that expresses the dependence of the shear strength of the mosh shoot root at 60.1 percent moisture is as follows: was determined to be:

$$P_k = -0,0458\, d_{il}^{\,2} + 4,744\, d_{il} + 2,9071 \quad (5)$$

The empirical equation that expresses the dependence of the shear strength of the mung bean arrowroot at 76.2 percent moisture on its thickness is found to be as follows:

$$P_k = -0{,}5326\, d_{il}\, 2 + 9{,}5784\, d_{il} - 10{,}836, \qquad (6)$$

here P_k – shear strength, N;

Table 1 shows the values of the cutting strength of the mung bean arrow root. Analyzing the graph showing the dependence of the arrow root cutting force on its thickness, it is possible to draw the following conclusion: when the root moisture content is 60.1 percent and its thickness is 1.9 mm, its cutting force is 13 N did When the root thickness increased by 2 times, the cutting force also increased by approximately 2 times and was 20.5 N. Then, the increase in root thickness by 1.3 times resulted in an increase in cutting force by 34.7 N.

1-table

Cutting forces of mung bean roots

Indicators	Root moisture, %	
	60,1	76,2
$M_{o'r}$, N	24,1	21,8
$\pm\sigma$, N	0,919	0,917
V, %	3,81	4,20

The cutting force was directly proportional to the root thickness and was found to vary from 13 N to 34.7 N. Keeping the above relationship, the shearing strength of the mung bean arrow root at 76.2% moisture content is directly proportional to the root thickness, and its graph is shifted lower than at 60.1% moisture content.

CONCLUSIONS

From this it can be concluded: the higher the moisture content of the mosh root, the smaller the effort required to cut it. Comparing the values of the average cutting and breaking forces, it was determined that the breaking force of the mung bean root is 2.5 times greater than the cutting force of the root at this moisture level.

REFERENCES

1. K. D. Astanakulov, Kh. M. Babaev, Kh. M. Eshankulov and I. M. Turdibekov Development of technology and equipment for harvesting mung bean crops. IOP Conf. Series: Earth and Environmental Science, 1112 (2022) 012008
2. Koychiev O.R., Soatov A., Orazaliev F. Grounding of the optimal parameters of the peanut digging claw // Collection of scientific papers of the II Republican scientific and technical conference on the topic of problems of applying innovative ideas, technologies and projects to production. - Jizzakh, 2010. p. 107-108.
3. B.M. Khalikov, S.T. Negmatova "Mung bean" monograph, Tashkent. "Navroz" publishing house, 2020, 188 pages.
4. Rasulov A.D. Basing the parameters and operating modes of the primary cleaning

machine for mung bean grain: Techn. Dissertation of the Doctor of Philosophy. - Yangiyol: AMSRI, 2020. - 126 p.

5. K.D. Astanakulov, I.M. Turdibekov, Technology of mung bean harvest. Republican Scientific and Practical Conference on "Science and Innovation 2022: Development and Priority Directions", NamQMI, 2022
6. www.fao.com