DEVELOPING MINCER HOUSEHOLD FOR OPTIMIZATION OF LEEK AIHAM PORRUM

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ABSTRACT

This research was carried out in Faculty of Agricultural Engineering, Al-Azhar university, Nasr city during 2016 season to leek cultivated after cutting leaves for slices (length slice 3 cm). The aim of green leek chop is to utilization of producing juicing which is considered as the most effective preparation for securing all health benefits of leek. To achieve this aim, a house mincer household with a (1.5 hp) motor was used. Factors studied were two type sample (head and lateral), two moisture content headed (69 and 85 %), lateral (68 and 80 %) and screen hole diameters (4, 5 and 6 mm) at rotation speed (400 , 500 and 600 rpm) with feeding mass 250 g. The performance of the chop was evaluated according to the chop. Productivity, energy requirements and sample content from protein and Fat. The results showed that the highest productivity was 11.54 kg / h lateral chop and highest productivity was 15.00 kg / h head chop and minimum specific energy 0.01 kw. h / kg lateral chop and minimum specific energy 0.08 kw . h / kg head obtained at 600 rpm and screen hole diameters 7 mm, 80 % moisture content for lateral sample and 85% moisture content for head sample while the requirement power highest 0.252 kw at 3 mm screen hole diameter, 80 % moisture content for lateral sample and 0.17 kw at 5 mm screen hole diameter, 68 % moisture content for lateral sample at rotation speed of 400 rpm, and the analysis of sample protein and fat contents of with lateral and head are (11.96 and 12.14 %) and(2.55 and 2.57 %) respectively.

INTRODUCTION

Www extension umn edu Leeks (Allium ampeloprasum var. porrum), family Alliaceae are a gourmet vegetable that may be grown easily. They have a mild onion flavor and are usually used in soup, but they may also be eaten raw, braised, or in casseroles or quiche.

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It can added in poultry and animal fodder. In Egypt, leek cultivated area about 2225 feddan which produced about 39,160 ton. Leeks resemble overgrown green onions, with a long, cylindrical white shaft, but the leaves are thick, flat and folded. Plants grow to 60 – 90 cm in height. The edible portion is the shaft, usually 15 - 25 cm long and up to 5 cm in diameter.

Leek – friend of the human body (2012) Leek has nutritional as the same of onion and garlic nutritional. Leek contains more protein than the garlic and onion. Beta carotene. Vitamin C, which is mostly contained in the green leaves of the leek. It is rich in minerals: manganese, folic acid, iron, magnesium, phosphorus, calcium, potassium. It is low calorie. It has an antibiotic effect, the presence of the allicin active antibiotic substance puts leek on the list of natural antibiotics. The use of leek in the diet, contributes to lowering of the blood pressure and the level of cholesterol in the blood. Leek is a natural preventive medicine for cardiovascular diseases. Strengthens the immune system and helps with colds and infections. Leek is rich in essential oils which increase the secretion of digestive juices and thus improve digestion. Leek is listed among natural diuretics because it contains a lot of potassium (300mg. potassium in 100gr. leek) and little sodium. It increases the secretion of liquids and toxic substances through the kidneys. Leek is often recommended to people with cardiovascular and kidney diseases, to reduce swellings. Because of this characteristic of his, leek is a natural "cleaner" of toxins. It contains vitamin E and carotene, which are important for healthy, elastic and gentle skin. Leek contains possible antioxidants which protect the organism from the negative influence of the free radicals, which can cause development of many chronic diseases, including cancer. Contains little fat and sugar, and a lot of cellulose which causes feeling of satiety, and thus it is ideal for maintaining a normal body weight during the winter.

Leek considered garlic family is as the most important and garlic products are being promoted in the from of volatile oils, juices, extracts in liquid and dried forms and macerates for utilization in pharmaceuticals and food preservation. Series of ant oxidative activity they are antiatheros clerolerotic, antihypertensive,

antimicrobial, anticancer, immunomodulation, and radioprotection (**Zeng et al.,2008).** Garlic is a potent natural antibiotic, it has anti-fungal and anti-viral properties and it has anti-oxidant properties. **(khanum et al.,1998)**. To exectract garlic juice the fresh garlic is milled to obtain a medium structured mash. Then the mash is pumped into a buffer tank where it is left for 15-60 min to complete enzymatic reactions. Juice extraction is done either by pressing or decantation. The juice is adjusted to the desired pH and passed through preheated. The juice is sterilized for few seconds after preheating **(Santhosha et al. 2013**). Leek juices is the most effective of the commercial preparation for obtaining all the health benefits of leek cloves are sliced, dried and then ground into powder before the allicin is formed **(Gara et al., 2000).**

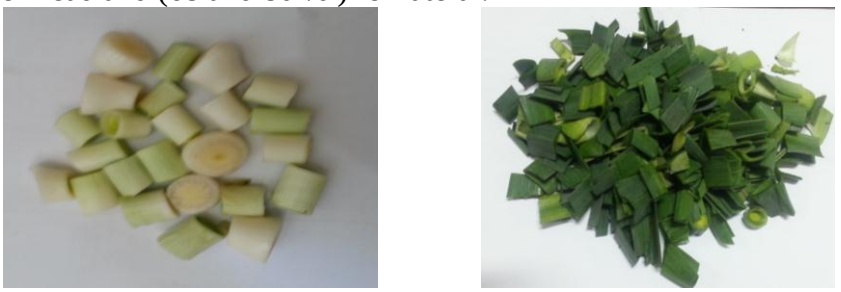
The main objective of this research is to test and performance evaluation of a small house mincer during cutting and crushing (chop) green leek. the optimize operating parameters

MATERIALS AND METHODS

The experiments were carried out at Faculty of Agricultural Engineering Al-Azhar University, Nasr City during 2016 season for house mincer.

Raw materiel:

Fresh leek cultivars were selected to apply this study after cutting and chop about 3 cm length as in Fig (1). with two moisture content (69 and 85 %) of head and (68 and 80 %) for lateral.



(A) **(B).**

Fig. (1): Photo of green leek head (A) and lateral (B).

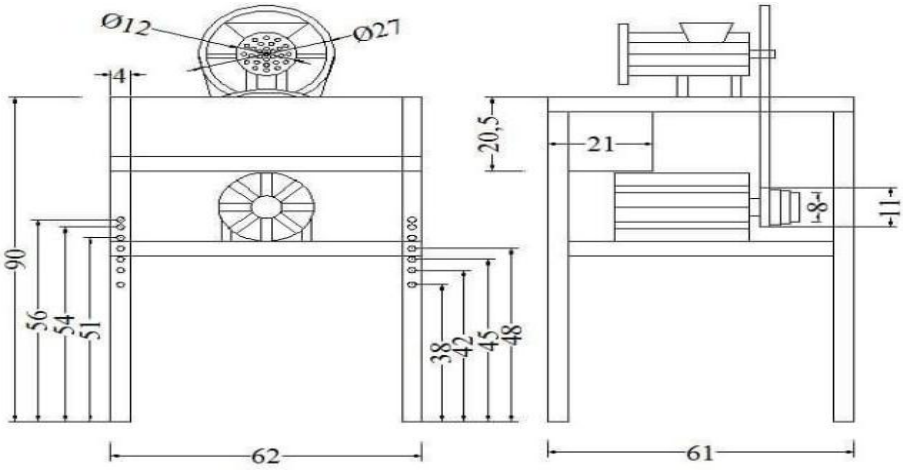
Mincer household prototype:

The prototype of mincer was constructed and fabricated in the workshop of Agricultural Engineering Faculty, Al-Azhar University, Nasr city, Cairo, Egypt. The prototype consists of house mincer, electric motor (1.5

Hp) and metal frame as in Fig (2 and 3). During this study the following parameter were tested: three screen holes diameter of 5, 6 and 7 mm, three speed of mincer of 400, 500 and 600 rpm and two moisture content of 69 and 85 % for head and 68 and 80 % for lateral.

Fig. (2):

Photograph of chop prototype



E.L **S.V**

Fig. (3): Elevation and side view of mincer prototype .

Measurements

1 – Moisture content:

The moisture content "M_c" was measured according to the ASAE standard (1994) by taking a sample. The average moisture content was

determined in (d.b) basis by using oven method at 377^{o}K (105^{0} C) for 24 hours and calculated by the following equation:

$$MC\ \% = (M_w - M_d) / M_d \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (1)$$

Where:

MC : moisture content (%).

M_w : sample mass before drying (g).

M_d : mass of dried sample (g)

2- Dimensional Characteristics of Fruit :

Characteristic dimensions as length "a and thickness "t" (mm) were measured by using digital dial caliber (accuracy of 0.01). These physical characteristics can be utilized effectively in machines design. Random samples of fifty fruit were taken. The three major dimensions, length (parallel with the longitudinal axle "a") and thickness (perpendicular on the longitudinal axle "b").

3- **Mass of Fruit:**

A random sample of fifty fruit ware taken and weighed by an electric digital balance model: 1431MB8-1 and of accuracy 0.01g.

4- Bulk density:

The bulk density was calculated for the fruits by dividing the mass of quantity of fruits on its volume.

$$\rho_d = \frac{W_s}{V_s} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (2)$$

Where:

ρ_d : Bulk density of fruits, (g/cm^3); Ws : Mass of the quantity of fruits, (g); and Vs : Volume of the quantity of fruits, (cm^3).

5 – Productivity:

Juicing time of 250 g of green leek head and leaves ware measured by means of a stopwatch to determine the house mincer productivity in kg/ h.

$$\text{Productivity} = \frac{\text{Mass of green leek leaves (kg)}}{\text{Time of green leek (h)}} \quad \ldots\ldots (3)$$

6 –power requirements:

A digital AVO meter was used for measuring the current Amber before and during experiments the total consumed electric power under working

load (kW) was calculated according **(Lockwood and Denstan, 1971)** by the following equation.

$$\text{Power (kw)} = \frac{(I.\ V.\ \eta.\ \cos\alpha)}{1000} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (4)$$

Where:

I : Current strength in Amperes.

V: Voltage strength (equal to 220 V),

Cosα : Power factor (equal to o.85) and

η : Mechanical efficiency assumed to be (90 %)

7 – Specific energy requirement:

The specific energy requirement (kW . h / kg) was calculated by using the following equation.

$$\text{Specific energy requirement} = \frac{\text{Power (kW)}}{\text{Productivity (kg / h)}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (5)$$

8 – Sample content from Protein and Fat

The analysis of the sample content from protein and fat with two moisture content of head and lateral used Appliance (NIRA-DA-1650 FOSS).

RESULTS AND DISCUSSION

The major dimensions:

Averages of three tow major dimensions of green leek length head diameter are shown in table (1). The measurements of length (a) and diameters (d) in (cm) of fifty fruits, randomly selected, were conducted. The highest value of fruit length and thickness was 14 and 2.6 cm respectively, while the lowest value of fruit length and diameter are 2.6 and 1.1 cm respectively.

Table (1): The 2 - Major dimensions of green leek head:

Dimensions	**Max.**	**Min.**	**Ave.**	**S.D**	**C.V %**
Length (cm)	14	6	9.59	2.05	21.37
diameter **(cm)**	2.6	1.1	1.79	0.36	20.11

Figs. (4 and 5) showed that the highest frequency of green leek head length and diameter ware 42 and 40% at (8.1 – 1.0 cm) and (1.5 – 1.8cm) respectively.

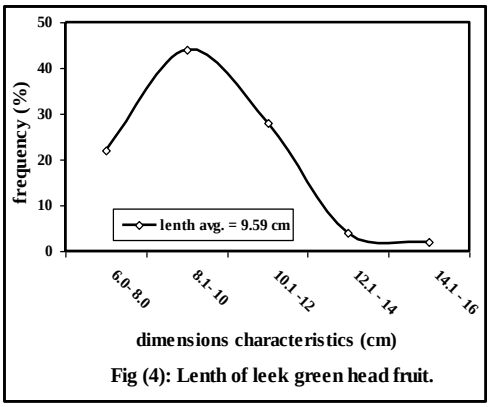


Fig (4): Lenth of leek green head fruit.

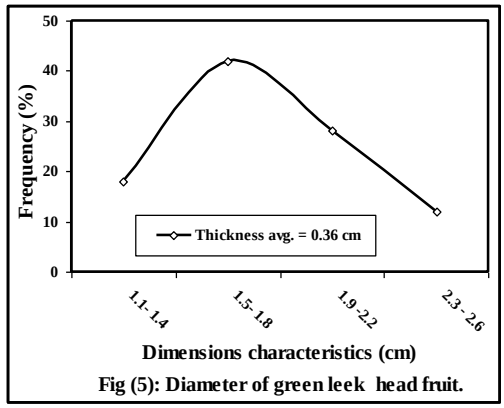


Fig (5): Diameter of green leek head fruit.

Averages of two major dimensions of green leek lateral are shown in table (2). The measurements of length (a) and diameter (d) in (cm) of fifty fruits, randomly selected, were conducted. The highest value of fruit length and diameter ware 72 and 2.4 cm respectively, while the lowest value of fruit length and diameter were 2.4 and 1.1 mm respectively.

Table (2): Tow major dimensions of green leek lateral:

Dimensions	Max.	Min.	Ave.	S.D	C.V %
Length (cm)	72	43	52.58	8.76	16.66
Thickness (cm)	2.4	1.1	1.78	0.45	25.28

Figs. (6 and 7) showed that the highest frequency of green leek lateral length and diameter ware 45 and 33% at (3.4 – 3.6 cm) and (1.4 – 1.5cm) respectively.

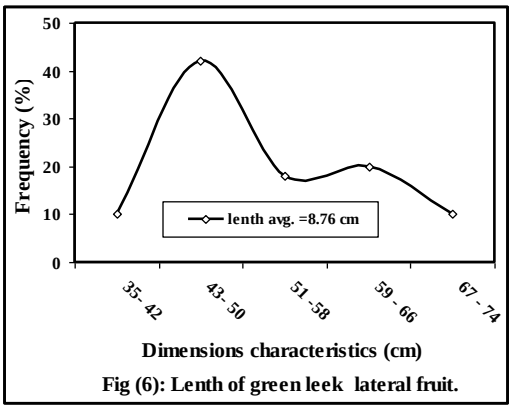


Fig (6): Lenth of green leek lateral fruit.

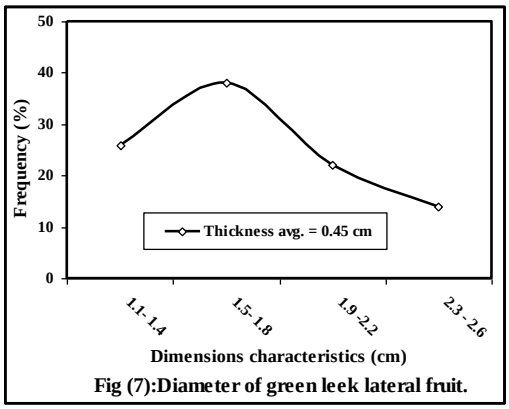


Fig (7):Diameter of green leek lateral fruit.

bulk density of head and lateral :

The measurements of mass and bulk density of green leek head and lateral under study . were conducted in three replicates. Table (3) shows that the head fruits gave values of 1245 (g) and 0.27 (g/cm^3) for mass and bulk density respectively. Also, it shows that the lateral fruits gave values of 2098g and 0.098 g/cm^3 for mass and bulk density respectively. The percentage of the head mass to the lateral mass was about 59.34 %.

Table (3): The mass and bulk density of fifty fruits of green leek head and lateral.

	Bulk density (g/cm^3)
Head	0.27
Lateral	0.098

Effect of screen holes diameters, mincer speed and moisture content on mincer productivity:

Fig. (8) showed the relationship between the screen holes diameters and mincer productivity (kg\h) at different tree mincer speed for leek head at moisture content of 85 w.b %. The obtained data showed that the mincer productivity increased with increase of both screen holes diameters and mincer speed, The maximum value of mincer productivity was (15 kg\h) at screen holes diameter of 7 mm and mincer speed of 600 rpm, while the lower value of mincer productivity was (5 kg\h) at screen holes diameter of 5 mm and mincer speed of 400 rpm

Fig. (9) showed the relationship between the screen holes diameters and mincer productivity (kg\h) at different tree mincer speed for leek head at moisture content 69 w.b %. The obtained data showed that the mincer productivity increased with increasing of both screen holes diameters and mincer speed. The maximum value of mincer productivity was (11.19 kg\h) at screen holes diameter of 7 mm and mincer speed of 600 rpm, while the lower value of mincer productivity was (4.09 kg\h) at screen holes diameter of 5 mm and mincer speed of 400 rpm

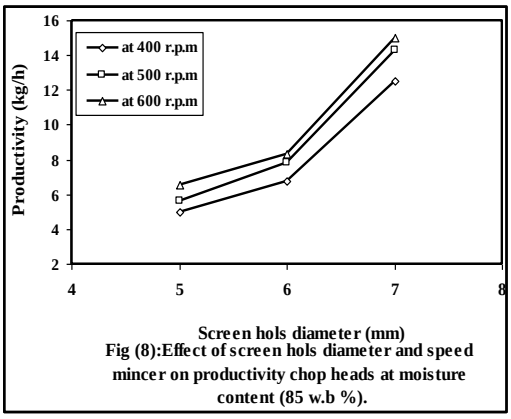


Fig (8):Effect of screen hols diameter and speed mincer on productivity chop heads at moisture content (85 w.b %).

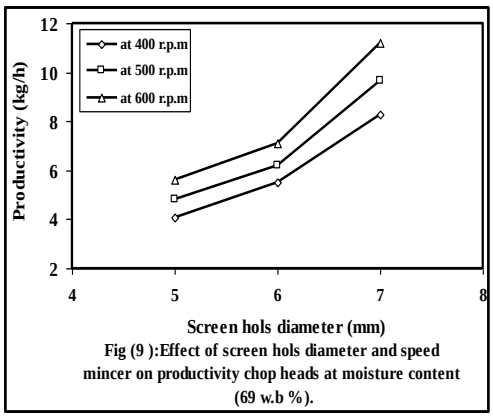


Fig (9):Effect of screen hols diameter and speed mincer on productivity chop heads at moisture content (69 w.b %).

Fig. (10) showed the relationship between the screen holes diameters and mincer productivity (kg\h) at different tree mincer speed for leek head at moisture content 80 w.b %. The obtained data showed that the mincer productivity increased with increase of both screen holes diameters and mincer speed, The maximum value of mincer productivity was (11.54 kg\h) at screen holes diameter of 7 mm and mincer speed of 600 rpm, while the lower value of mincer productivity was (3.11 kg\h) at screen holes diameter of 5 mm and mincer speed (400rpm)

Fig. (11) showed the relationship between the screen holes diameters and mincer productivity (kg\h) at different tree mincer speed for leek head at moisture content 68 w.b %.

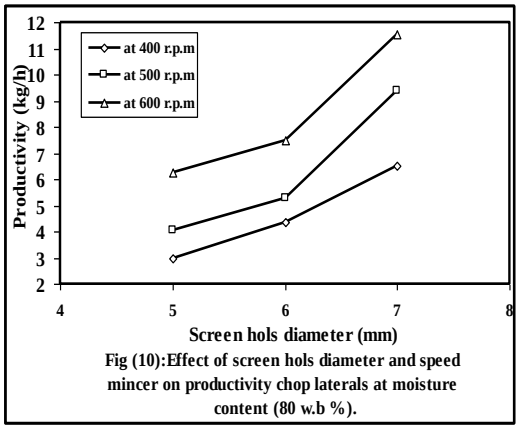


Fig (10):Effect of screen hols diameter and speed mincer on productivity chop laterals at moisture content (80 w.b %).

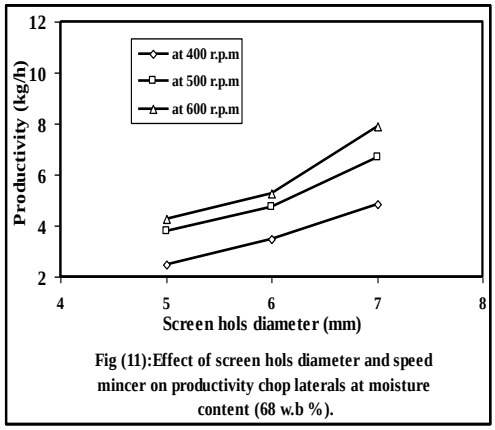


Fig (11):Effect of screen hols diameter and speed mincer on productivity chop laterals at moisture content (68 w.b %).

The obtained data showed that the mincer productivity increased with increasing of both screen holes diameters and mincer speed, The maximum value of mincer productivity was (7.89 kg\h) at screen holes diameter of 7 mm and mincer speed of 600 rpm, while the lower value of mincer

productivity was 2.5 kg\h) at screen holes diameter of 5 mm and mincer speed of 400 rpm.

Effect of screen holes diameters, mincer speed and moisture content on mincer specific energy:

Fig. (12) showed the relationship between the screen holes diameters and specific energy requirement (kW.h/kg) at different thare mincer speed for leek head at moisture content (85 w.b %). The obtained data showed that the specific energy requirement (kW.h/kg) decreased with increase of both screen holes diameters and mincer speed, The maximum value of mincer specific energy. was (0.29 kW.h/kg) at screen holes diameter of 5 mm and mincer speed of 400 rpm, while the lower value of Specific energy requirement was (0.005 kW.h/kg) at screen holes diameter of 7mm and mincer speed of 600 rpm

Fig. (13) showed the relationship between the screen holes diameters and Specific energy requirement (kW.h/kg) at different tree mincer speed for leek head at moisture content 69 w.b %. The obtained data showed that the specific energy requirement (kW.h/kg) decreased with increaing of both screen holes diameters and mincer speed.The maximum value of mincer specific energy. was (0.04 kW.h/kg) at screen holes diameter of 5 mm and mincer speed of 400 rpm, while the lower value of mincer productivity was (1.01 kW.h/kg) at screen holes diameter of 7 mm and mincer speed of 600 rpm

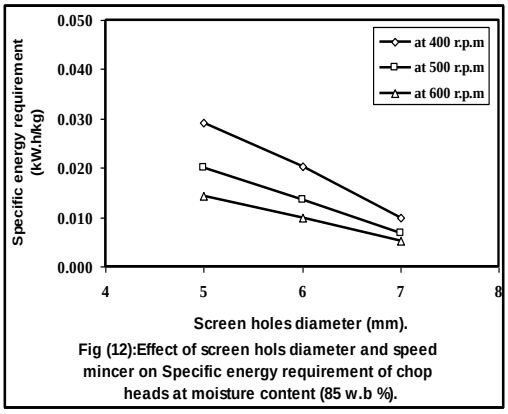


Fig (12):Effect of screen hols diameter and speed mincer on Specific energy requirement of chop heads at moisture content (85 w.b %).

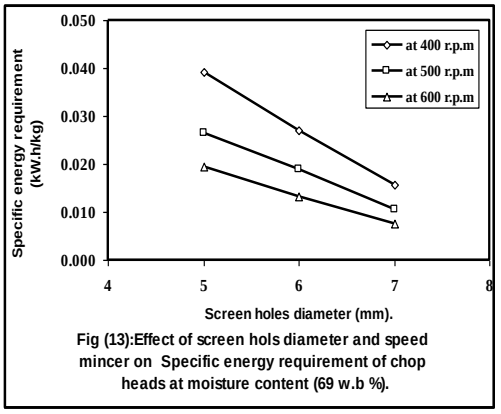


Fig (13):Effect of screen hols diameter and speed mincer on Specific energy requirement of chop heads at moisture content (69 w.b %).

Fig. (14) showed the relationship between the screen holes diameters and Specific energy requirement (kW.h/kg) at different tree mincer speed for leek lateral at moisture content 80 w.b %. The obtained data showed that the

Specific energy requirement (kW.h/kg) decreased with increase of both screen holes diameters and mincer speed, The maximum value of mincer specific energy. was (0.05 kW.h/kg) at screen holes diameter of 5 mm and mincer speed of 400 rpm, while the lower value of specific energy requirement was (0.01 kW.h/kg) at screen holes diameter of 7mm and mincer speed of 600 rpm

Fig. (15) showed the relationship between the screen holes diameters and Specific energy requirement (kW.h/kg) at different tree mincer speed for leek lateral at moisture content 68 w.b %. The obtained data showed that the specific energy requirement (kW.h/kg) decreased with increase of both screen holes diameters and mincer speed. The maximum value of mincer specific energy. was (0.07 kW.h/kg) at screen holes diameter of 5 mm and mincer speed of 400 rpm, while the lower value of mincer productivity was (0.01 kW.h/kg) at screen holes diameter of 7 mm and mincer speed of 600 rpm

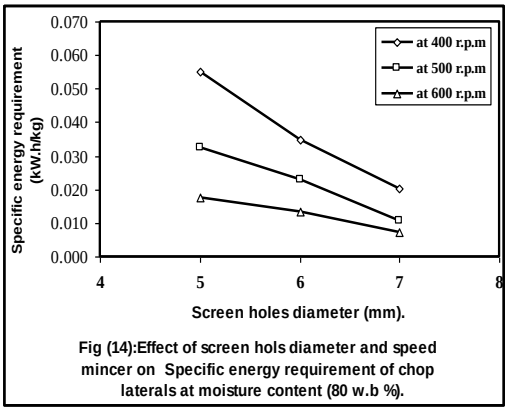


Fig (14):Effect of screen hols diameter and speed mincer on Specific energy requirement of chop laterals at moisture content (80 w.b %).

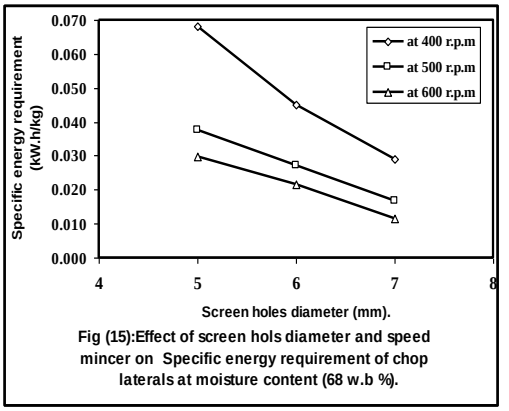


Fig (15):Effect of screen hols diameter and speed mincer on Specific energy requirement of chop laterals at moisture content (68 w.b %).

Effect of screen holes diameters, mincer speed and moisture content on bulk density of green leek choped:

Fig. (16) showed the relationship between the screen holes diameters and bulk density (g/cm3) at different thare mincer speed for leek head at moisture content (85 w.b %). The obtained data showed that the bulk density decreased with increase of both screen holes diameters and mincer speed. The maximum value of mincer bulk density was (0.655 g/cm3) at screen holes diameter of 5 mm and mincer speed of 400 rpm, while the lower value of mincer bulk density was (0.524 g/cm3) at screen holes diameter of 7 mm and mincer speed of 600 rpm.

Fig. (17) showed the relationship between the screen holes diameters and bulk density (g/cm3) at different tree mincer speed for leek head at moisture content 69 w.b %. The obtained data showed that the bulk density decreased with increase of both screen holes diameters and mincer speed, The maximum value of mincer bulk density was (0.639 g/cm35) at screen holes diameter of 5 mm and mincer speed of 400 rpm, while the lower value of mincer bulk density was (0.504 g/cm3) at screen holes diameter of 7 mm and mincer speed of 600 rpm.

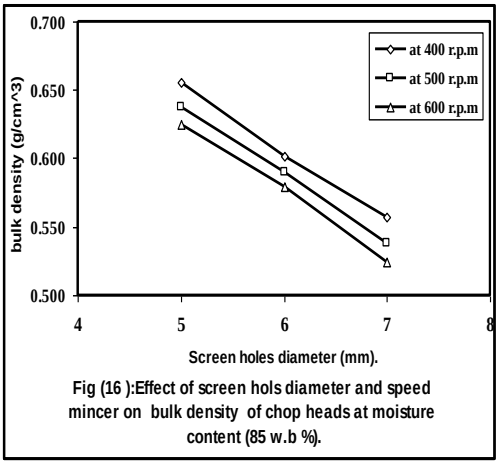


Fig (16):Effect of screen hols diameter and speed mincer on bulk density of chop heads at moisture content (85 w.b %).

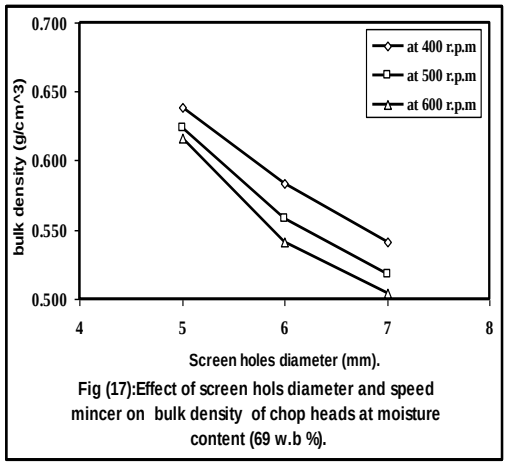


Fig (17):Effect of screen hols diameter and speed mincer on bulk density of chop heads at moisture content (69 w.b %).

Fig. (18) showed the relationship between the screen holes diameters and bulk density (g/cm3) at different tree mincer speed for leek head at moisture content 80 w.b %. The obtained data showed that the bulk density decreased with increase of both screen holes diameters and mincer speed, The maximum value of mincer bulk density was (0.758 g/cm3) at screen holes diameter of 5 mm and mincer speed of 400 rpm, while the lower value of mincer bulk density was (0.667 g/cm3) at screen holes diameter of 7 mm and mincer speed. of 600 rpm.

Fig. (19) showed the relationship between the screen holes diameters and bulk density (g/cm3) at different tree mincer speed for leek head at moisture content 68 w.b %. The obtained data showed that the bulk density decreased with increase of both screen holes diameters and mincer speed. The maximum value of mincer bulk density was (0.733 g/cm3) at screen holes diameter of 5 mm and mincer speed of 400 rpm, while the lower value of mincer bulk density was (0.635 g/cm3) at screen holes diameter of 7 mm and mincer speed of 600 rpm.

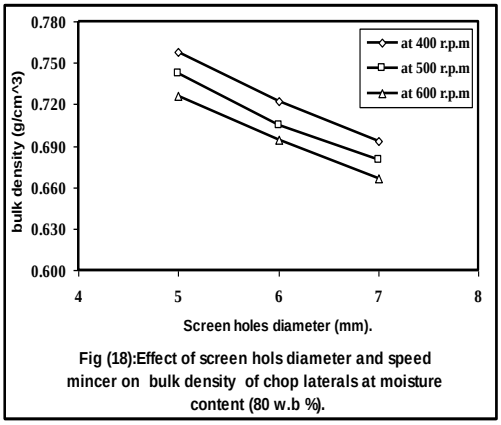


Fig (18):Effect of screen hols diameter and speed mincer on bulk density of chop laterals at moisture content (80 w.b %).

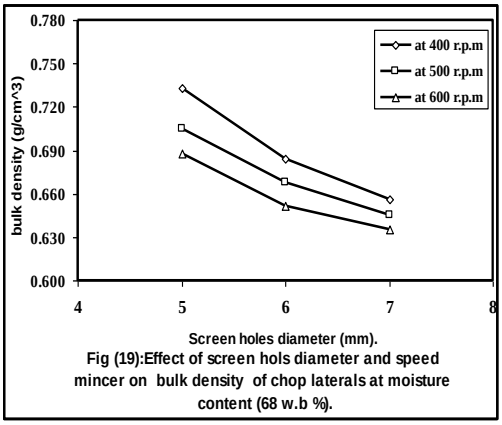


Fig (19):Effect of screen hols diameter and speed mincer on bulk density of chop laterals at moisture content (68 w.b %).

Sample content from Protein and Fat

The obtained sample content by chemical analysis. Ratio of protein, Fat used two sample (lateral and head) was (11.96 and 2.55 %), (12.14 and 2.57 %) respectively.

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الملخص العربى

تطوير المفرمة المنزلية لتعظيم الاستفادة من الكرات

د/ محمد أحمد شتيوى*

يعتبر الكرات من محاصيل الخضر في مصر وله أهمية كبيرة حيث يستخدم في كثير من الصناعات الغذائية بالإضافة إلي الاستخدام المنزلي ويدخل في كثير من الاستخدامات الطبية ويعمل كمضاد حيوي في مزارع الدواجن . وتم إجراء هذا البحث خلال موسم ٢٠١٦ م في كلية الهندسة الزراعية جامعة الأزهر.

ويهدف البحث إلي الاستفادة من محصول الكرات الأخضر عن طريق فرمها للاستفادة المنزلية خلال العام كله حيث تم الفرم آلة لفرم الكرات قدرته ١.٥ حصان ، وللوصول إلي هذا الهدف تم اختيار عينتان للفرم (الرأس والأوراق) بنسب رطوبة (٨٥ و٦٩ % للرأس) (٨٠ و٦٨ % للأوراق) وثلاث فتحات للفرم (٥ ، ٦ ، ٧ مم) وتقطيعها إلي شرائح طولها ٣ سم مع سرعة سكينة للخلاط ٤٠٠،٥٠٠ ٦٠٠لفة / د والكرات المستخدم (الصنف البلدي). وتم تقيم أداء المفرمة من خلال إنتاجية المفرمة والقدرة المطلوبة والطاقة النوعية المطلوبة للفرم والكثافة قبل وبعد الفرم والنسبة المئوية لمحتوي العينة من البروتين والدهون للرأس والعروش

وكانت أهم النتائج:

- كانت اعلي إنتاجية للآلة ١٥ كجم / س للرأس مع نسبة رطوبة ٨٥ % و ١١.٥٤كجم / س للأوراق مع نسبة رطوبة ٨٠ % عند استخدام فتحة ٧ مم وسرعة دوران للآلة ٦٠٠ لفة / د .
- كانت اعلي قدرة مطلوبة للفرم ٠.١٦ كيلووات عند نسبة رطوبة ٦٩ % للرأس وكانت ٠.١٧ كيلووات للأوراق مع نسبة رطوبة ٦٨% مع استخدام فتحة ٥ مم وسرعة دوران للآلة ٤٠٠ لفة / د
- كانت اقل طاقة نوعية مطلوبة للآلة ٠.٠٠٥ كيلووات . س / كجم عند نسبة رطوبة ٨٥ % للرأس وكانت ٠.٠٠٧ كيلووات .س / كجم للأوراق عند نسبة رطوبة ٨٠ % مع استخدام فتحة ٧ مم وسرعة دوران للآلة ٦٠٠ لفة / د
- كانت أعلى كثافة بعد الفرم ٠.٦٣٩ جم/ سم٣ عند نسبة رطوبة ٦٩ % للرأس وكانت ٠.٧٥٨ جم/ سم٣ للأوراق عند نسبة رطوبة ٨٠ % مع استخدام فتحة ٥ مم وسرعة دوران للآلة ٤٠٠ لفة / د
- وقد أظهرت نتائج التحليل الكيميائي أن نسبة البروتين والدهون للرأس والأوراق (١٢.١٤ و ١١.٩٦ %) بروتين و(٢.٥٧ و ٢.٥٥ %) دهون.

*** أستاذ ورئيس قسم المنشآت الزراعية والتحكم البيئى المساعد بكلية الهندسة الزراعية- جامعة الأزهر.**