Design and Construction of Leaf Sewing Machine and Collector For Oriental Tobacco

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ABSTRACT: One of cultivation of tobacco process that requires most labor is stringing process. This survey was done for localization and determination of stringing machine performance on oriental tobacco and also determination the percent of labor saving in comparison with traditional stringing method. Factorial experiment was in a randomized block complete design in 3 replications with 9 treatments in Tirtash research and education center in 2014-2015 years. This study was done with basma cultivation in a 5000 m² plot and all of the planting to harvesting steps was done according to tradition. Treatments were three of curing methods (collector, traditional barn and modern barn) and three methods: traditional stringing with hand, stringing machine and rack machine. Number of Labor, stringing time, labor costs, total cost, price of tobacco, sugar and nicotine percent and etc. were calculated. Results showed that traditional stringing and sewing machine have the highest and lowest labor cost about 20 million rials and 6000000 rials respectively. Using of sewing machine reduced number of labor and labor cost about 75% in hectare for technology process. The most needling time was related to hand needling by 792 hr/ha and the least needling time was related to electric needling by 190 hr/ha. The most green weight was related to rack machine needling by 3 kg per string and the least green weight was related to electric needling by 1.23 kg per string. Most dry material percentage was related to traditional barn. Treatment of electric sewing machine had the most net income. Traditional barn and modern barn had the highest percentage of energy consumption (90-100%) and collector had the lowest percentage of energy consumption (0%). Results showed that Using of collector system and sewing machine in technology steps of oriental tobacco, reduced number of labor, energy and costs, save of time and increased quality of tobacco (20-30%), efficiency and safety.

Keywords: Stringing, Sewing machines, collector, oriental tobacco

INTRODUCTION

Tools, implements and powered machinery are essential and major inputs to agriculture. The term mechanization is generally used as an overall description of the application of these inputs (Clarke, 2000). Olaoye and Rotimi 2010 affirmed that the agricultural mechanization level of a country is technically expressed in terms of hp/ha standard being 1.5/2 hp/ha, kW/ha, ha/tractor, number of tractors/1000 ha, equipment weight/tractor and mechanical power/total power practicable, beneficial and sustainable in an area. Oriental tobacco is one of the major traditional crops in IRAN North. Oriental tobacco is a plant compatible for growing on soil conditions, not suitable or profitable for growing other types of agricultural products. It is often grown in poorer soils and in areas with higher aridity. IRAN has favorable soil and climatic conditions and tradition for growing mostly small-leaf oriental or aromatic types of tobacco and very small quantities of big-leaf types of tobacco. The harvested leaves are all stringing with hand and cured in traditional barn (no standard) and the characteristic golden-yellow leaf is widely famous for its quality characteristics. Oriental tobaccos are known by their high aroma from the small leaves, being low in both sugar and nicotine. (Mohsnzadeh et al., 2014) reported the use of intelligent systems has positive effect on improving the quality and management of resources. This system is optimal for reduce production costs (cost and number of hours worked. The best way is to use of semi-automatic.(Ahmadi et al., 2012) defined that Using of stringing machine reduced number of labor (88/5%in hectare) and increased number of tobacco containing strings (78% per day) for air-cured tobacco. To make a reliable plan to develop the agriculture of a region, it is important to gain a precise knowledge of the existing situation and the problems facing the development of agriculture. Otherwise, any long-, middle-and short-term plans will be ineffective and finally problematic and they will lead to a waste of capital and time. This is of crucial importance in undeveloped countries because of limited capital and economic depression. However there are many areas with potential for development in these countries. One of the main reasons, and probably the most important one, for this kind of social structure is the dependence of these countries on traditional agricultural systems with a low level of
efficiency hence remaining victims of food insecurity. Therefore, attempts to find a solution to enhance the effectiveness of agriculture in the economy of these countries must be taken into consideration as one of the main goals. By definition, the mechanization of agriculture is the "application of mechanical implements or as a whole, the application of the state-of-the-art technologies in agriculture to increase productivity and to reach sustainable agriculture". There are three specific indices for the study and evaluation of mechanization in different regions. These indices include degree, level, and Capacity of mechanization (Almasi et al., 2000). The level, appropriate choice and subsequent proper use of mechanized inputs into agriculture has a direct and significant effect on achievable levels of land productivity, labor productivity, the profitability of farming, the sustainability, the environmental and, on the quality of life of people engaged in agriculture (Olaoye and Rotimi, 2010). (Starkey, 1998) defined farm mechanization as the development and introduction of mechanized assistance of all forms and at any level of sophistication in agricultural production to improve efficiency of human time and labour. Increased levels of farm power and mechanization is therefore one of the major factors required to increase production. (Chisango and Obi, 2011) highlighted that a series of mechanization phases, following the Fast Track Land Reform in Zimbabwe were poorly planned and chaotically implemented. This investigation was carried out in Matepatepa area of Bindura district in Mashonaland central province to study the situation of mechanization in the region and to analyze the relevant qualitative and quantitative issues. Principally agricultural mechanization involves the use of tools, implements and machines to improve the efficiency of human time and labour. The most appropriate machinery and power source for any operation depends on the work to be done, cultural settings, affordability, availability and technical efficiency of the options. These indications were clearly evident that agricultural mechanization is not an end in itself, but a means of development that must be sustained. Therefore a socially beneficial agricultural production is determined based on a wide range of social, economic and ecological factors. These factors determine whether a technology is practicable, beneficial and sustainable in an area (Olaoye and Rotimi, 2010).

**MATERIAL AND METHODS**

This study was done with factorial experiment in a randomized block complete design in 3 replications with 9 treatments in Tirtash research and education center in 2014-2015 years. Treatments were three of curing methods collector, traditional barn (control), modern barn and three methods: traditional stringing with hand (control), sewing machine and rack machine. In this study, we designed and created a sewing machine for oriental tobacco with the following specifications (Fig. 6): The machine has Dimensions of 45 cm (Width) × 320 cm (length) with one electromotor (230volt and 1 Hp), start key, conveyor strip (3 numbers), 3belts, stylus (1 number), Electric reciprocating, Regulators lever, one tray (40cm×130cm), Wheel carrier (4 numbers) and Roller conveyors (6number). The modern barn has Dimensions of 200 cm (Width) × 220 cm (Height) × 300 cm (Length) with four rows. This barn has strings with leaves for 4 cm distance (300 strings in barn) and fan with a power air movement around 8000cubic meters per hour and a gas burner with a thermal capacity is 98,000 kcal. Traditional barn was without fan and control system and with the following specifications 400 cm (Width) × 350 cm (Height) × 500 cm (Length) (70m³ of space by 300-400 strings in barn. Collector has 5m (Width) × 2m (Height) × 30m (Length) and 600 strings in collector (Fig. 7). This covered with nylon. This method hasn’t dependent to gas or gasolin and electricity energy. After the construction of barns, oriental tobacco seedlings were transplanted in mid-April. General practices (pest and diseases, weeds) and priming operation were done at the right time. The leaves were placed inside the racks or stringing and then into barns. Then all the leaves were cured in three curing methods and traditional stringing with hand, stringing machine and rack machine in four Pick up. After the leaves were cured then were separated according to color, size and quality and then were evaluated. Leaf samples were analyzed to determine the chemical properties of the leaf (reducing sugars, nicotine). Number of Labor, stringing time, labor costs, total cost, and price of tobacco, gas and electricity consumption treatments, and etc were measured. Data analysis was performed to compare them using the Mstastic program.

**RESULTS AND DISCUSSION**

Analysis of variance treatments (Table 1 and 2) showed that the treatments evaluated in time of work, labor number, cost, the quality (price), the amount of energy consumption, dry weight percentage nicotine, sugar, and etc. significant difference in levels 1% and 5% .

**Table1. Analysis of variance the different treatments**

<table>
<thead>
<tr>
<th>Factor</th>
<th>df</th>
<th>Time of work</th>
<th>Year(Y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of labor</td>
<td>1/2</td>
<td>52</td>
<td>1</td>
</tr>
<tr>
<td>Net income</td>
<td>1/8</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>Dry weight</td>
<td>3/4</td>
<td>7/4</td>
<td></td>
</tr>
<tr>
<td>Green leaves</td>
<td>0/07</td>
<td>4534365542</td>
<td></td>
</tr>
<tr>
<td>per string</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality (price)</td>
<td>1/2</td>
<td>11973029</td>
<td></td>
</tr>
<tr>
<td>Labor number</td>
<td>3</td>
<td>239</td>
<td>4</td>
</tr>
<tr>
<td>Time of work</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

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The highest efficiency and safety. These treatments had the minimum of efficiency (20%) and safety about 2/5 (Fig. 2). Collector and sewing machine had the lowest labor, energy consumption, costs, hours of work (Table 3). The treatment reduced about 75% of labor and cost.

A) Time of work:
The results showed that the leaves stringing treatment (control) had the highest time of work with a total of 792 hours due to stringing leaves with hand. Number of leaves oriental tobacco in hectare are 7-8 million with size 20-25×10-12 cm (Table 3). The treatment of sewing machine had lowest Hours of work (190 hr.). This treatment reduced about 75% of time. (Zhang et al., 2013) reported Reduction of working hours on the use of intelligent systems.

B) Numbe labor and labor cost:
Treatments in the number of workers and labor costs had significant differences at the one percent level (Table 1). Sewing machine treatment had the lowest number of workers, and costs with 25 numbers per hectare and cost about 6 million rials/hac (Table 3 and fig 3). This treatment reduced about 75% of labor and cost. (Ahmadi et al., 2012) found similar results.

C) The quality (Price) and wastes:
Treatments were different for the average price (quality) and wastes of tobacco. Treatment of rack machine × traditional barn and rack machine × collector had the lowest price. (Fig. 4). The low price causes high waste. Because it can be due to density of leaves and curing conditions. (Lopez et al., 2005) reported a good quality tobacco leaf used in intelligent and mechanization systems.

D) Energy consumption percentage:
Traditional barn and modern barn treatments had more energy consumption percent due to use of gas and electricity (90-100%). Collector hadn’t energy consumption and was 0%. Because it can be use of sun (fig.1). (Larry, 2008) and (Lopez et al., 2005) reported reduction of energy consumption in the use of intelligent systems.

E) Efficiency and Safety:
Treatments were different for the efficiency and safety in 1% levels (Table 2). Modern barn and traditional barn had the minimum of efficiency (20-30%) and safety about 2/5 (Fig. 2). collector and sewing machine had the highest efficiency and safety. These treatments had the lowest labor, energy consumption, costs, Hours of work.
work. It was the best treatment in the increase of quality and net income. Collector system had more safety due to not use of gas and electricity for human and environment. (Mohsenzadeh et al., 2014) reported that the use of intelligent systems has positive effect on efficiency, safety and reduce production costs.

**F) Environmental pollution:**
Control treatment had the highest environmental pollution due to increased gas or consumption and greenhouse gases emissions (fig. 1).

**G) Net income:**
The results showed that the sewing machine treatment had the most net income (15-20%) for farmer (82 million rials in hac). Sewing machine in curing methods (collector, traditional barn, modern barn) had the most income in hectare. Because it reduced of labor cost and increased quality and price of tobacco (fig. 3 and 5). (Ahmadi et al., 2012) and (Mohsenzadeh, 2014) defined that use of mechanization and intelligent systems in air-cured and flue-cured tobacco increased net income.

**H) Green weight of leaves per string:**
Green Weight of leaves per string had significantly different (Table 2). Rack machine had the highest of green weight of leaves per string (3 Kg) but others treatments had the lowest (1/5-2 kg) (Table 3). Because, density of leaves were higher in rack machine strings. (Ahmadi et al., 2012) Concluded that Using of stringing machine increased number of tobacco containing strings (78% per day).

**I) Chemical characteristics:**
Collector treatment had the lowest nicotine and sugar Compared with other treatments (Tables 2, 3). Changes in Chemical characteristics of tobacco leaves are influenced by culture conditions, genetic varieties and curing conditions. Modern barn treatment had the lowest of Chemical characteristics due to better curing conditions.

**J) Percent of dry weight:**
Traditional barn had the highest Percent of dry weight (18%) Compared with other treatments (Tables 2, 3). This factor is related to curing conditions.

**CONCLUSION**
The use sewing machine has positive effect on reduce of labor number and costs and improving management of resources. This system is optimal for reduce production costs. Collector method is optimal for curing of tobacco, for not use of energy gas and gasoline. This methodes can be used for other agricultural products for example: Raisins, bean, cereal and etc.

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**Fig1.** Percentage of energy consumption (Gas/gasoline and Electricity) and pollution in treatments
Fig 2. Amount of safety and efficiency in treatments

Fig 3. Net income and cost of labor (rial in hac) in sewing methods

Fig 4. Tobacco Price (rial) in treatments

Fig 5. Net income (rial/hac) curing×sewings
Fig 6. sewing machine for oriental tobacco leaves

Fig 7. Collector for oriental tobacco curing leaves

REFERENCES


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