Design and Construction of Modern Barn and Rack System for Oriental Tobacco (Var. Basma 178-2)

R Mohsenzadeh
Researchrs of Tirtash Research and Education Center, Iranian Tobacco Company

ABSTRACT: Tobacco curing and stringing are important processes for the oriental tobacco production. To get high quality and reduce the production costs, mechanization facilities are used to the curing process is currently available. As the labor cost increasing, it is essential to reduce the labor and the workload required in process of after harvesting leaves, reduce the fuel consumption and increase the benefits of the tobacco production. This study was carried out for design and construction of modern barn and rack system in technology steps of oriental tobacco and in comparison with traditional method on quality characteristics, production and labor costs and save of time. This study was done in Tirtash Research and Education Center at 2014-2015 for the first time. Leaves were harvested in 4 picks up cured with 3 treatments. The modern barn has 13m$^3$ of space with four rows of racks (120 numbers). This barn has intelligent control system in processing steps of oriental tobacco in phases Manual, semi-automatic and automatic. This section has a fan with a power air movement around 8000-12000 cubic meters per hour and a gas burner with a thermal capacity is 98,000 kcal. Else barn is similar to the first barn but it hasn’t racks. This barn has strings with leaves for 4 cm distance and a fan with a power air movement around 6000-8000 cubic meters per hour. Final treatment is traditional barn without fan and control system 70m$^3$ of space and stringing method (300-400 strings in barn).Results showed that Using of modern barn system and rack 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 income, green weight of leaves (Kg) in cubic meters per barn. This system can be used to control the production parameters in the technology processes for oriental tobacco leaves. It has characters of convenience, high level of mechanization, high efficiency and low labor cost. This barn can be used for drying of other agricultural products for example: Ears of rice, Bean, Straw, forage, growth of Mushrooms and etc.

Keywords: oriental tobacco, modern barn system, Design, construction, rack

INTRODUCTION

Oriental tobacco is one of the major traditional crops in IRAN. 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 (7/000/000-8/000/000 leaves in hectare), (size of leaves are 20-25×10-12 cm), 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). 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). 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). (Ozmerzi, 1998) affirmed that the agricultural mechanization level of a country is technically expressed in terms of hp/ha standard being 1.5/2hp/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 (Olaoye and Rotimi, 2010).

MATERIAL AND METHODS

In this study, we had three treatments: an modern barn system for oriental tobacco (var. Basma178-2) processing was designed and built in Tirtash Research and Education Center, Iranian Tobacco Company at 2014-2015 year with the following specifications: The barn has Dimensions of 200 cm (Width) × 220 cm (Height) × 300 cm (Length) (13m³ of space) with four rows of racks (120 numbers). Racks were with the length and width 95×20 Cm. This barn has intelligent control system in processing steps of oriental tobacco in phases Manual, semi-automatic and automatic. This section has a fan with a power air movement around 8000-12000 cubic meters per hour and a gas burner with a thermal capacity is 98,000 kcal. Fan and burner by wires connecting the intelligent control system. Else barn is similar to the first barn but it hasn’t racks. This barn has strings with leaves for 4 cm distance (300 strings in barn). This barn has a fan with a power air movement around 6000-8000 cubic meters per hour and a gas burner with a thermal capacity is 98,000 kcal. Fan and burner by wires connecting the intelligent control system. Final treatment is traditional barn without fan and control system and with the following specifications 400 cm (Width) × 350 cm (Height) × 500 cm (Length) (70m³ of space) and stringing method (300-400 strings in barn). 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 barns under similar conditions in four Pick up and four replications. 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 and protein). The average price factors, times changes of temperature, labor number, gas and electricity consumption treatments were measured. Data analysis was performed to compare them using the Mstatc program.

RESULTS AND DISCUSSION

Analysis of variance treatments (Table 1 and 2) showed that the treatments evaluated in terms of hours worked, labor number, Total cost, the quality (price), the amount of energy consumption, percentage nicotine, sugar, protein, and etc. significant difference in levels 1% and 5%.
A) Hours of work:

The results showed that the control treatment (traditional barn and stringing) and modern barn and stringing with hand had the highest Hours of work with a total of 807 hours due to stringing leaves with hand. Number of leaves oriental tobacco in hectare are 7-8 million with size 20-25cm x 10-12 cm (Table 3). The treatment of modern barn with rack had lowest Hours of work. One rack has 6000gr of green leaves but a string has about 1000gr of green leaves (the size is the same) (Table 4). (Zhang et al., 2013) reported Reduction of working hours on the use of intelligent systems.

B) Numbe labor, labor and total costs:

Treatments in the number of workers and labor and total costs had significant differences at the one percent level (Table 1). Modern barn and rack treatment had the lowest number of workers, and costs with 163 number per hectare and cost about 34077 million rials/ hac (Table 3). (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 modern barn with rack had the best quality with about 98900 rials and the modern barn with stringing treatment was the lowest average price with 77250 rials and the highest of wastes (Tables 3, 4). Modern barn with rack system can lead toward a better and more quality of tobacco leaves with the lowest of wastes. Because it can be due to control of uniformity in temperature and relative humidity in barn. (Lopez et al., 2005) reported a good quality tobacco leaf used in intelligent and mechanization systems.

D) The amount of energy:

Control treatment had more energy (1220 m³ per hac of gas) due to lack of appropriate control conditions within the cabinet (Table 3), and larger space (70m³), but the other two methods (modern barn) had the lowest of energy (500-600m³ per hac of gas) use with intelligent control of temperature and humidity and smaller space(13m³). (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% and 5% levels respectively (Table 2). Barn modern with rack had the maximum of efficiency (60%) and safety about 4(Table 4). This treatment has the lowest labor, energy, costs, Hours of work and wastes. It was the best treatment in the increase of quality and net income. This system had more safety due to control of better from temperature, relative humidity and gas and use of intelligent systems with reaction to update alarms defined for fire and Power outages for human and system. (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 consumption (double) and greenhouse gases emissions (Tables 2, 4).

G) Net income:
The results showed that the modern barn with rack had the most net income (35-40%) for farmer. Because it reduced of total cost and increased quality and price of tobacco (Table 3). (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 cubic meters of barn:
Green Weight of leaves per cubic meters of barn had significantly different (Table 2). Barn modern with rack had the highest of green weight of leaves per cubic meters of barn (54 Kg) but control treatment had the lowest (15 Kg) (Table 4). A rack has about 6000gr leaves and string has 1000 gr. Space of modern barn is smaller (13m3) Compared with traditional barn (70m3).( Ahmadi et al., 2012) Concluded that Using of stringing machine increased number of tobacco containing strings (78% per day).

I) Chemical characteristics (Nicotine, sugar and protein):
Control treatment had the highest nicotine, sugar and protein Compared with other treatments (Tables 2, 4). 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.

CONCLUSION
The use of modern barn with rack 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 and etc.). This barn can be used for drying of other agricultural products for example: Ears of rice, Bean, Straw, forage, growth of Mushrooms and etc.

REFERENCES


Starkey, P. 1998. Integrating Mechanization into Strategies for Sustainable Agriculture Technical Centre for Agricultural and Rural Cooperation (CTA) Wageningen, the Netherlands.
