Journal of Agricultural, Food and Environmental Sciences, Vol 74 No 1 (2020)
DOI: https://doi.org/10.55302/JAFES20741038d

MECHANIZATION AND EQUIPMENT FOR THE USE OF WASTE WOOD FROM ORCHARDS AND VINEYARDS

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ABSTRACT

A large mass of different plant residues is found in agricultural production. They are the largest in viticulture and according to some analyzes there are about 35 - 40 thousand tons, but there are other residues from industrial production, agricultural production by about 45000 tons. However, the largest amount of plant wastes occur in the forestry of 550-600000 m^3 of wood mass after logging as wood waste. These are large quantities that can be used as an alternative fuel, because from one kilogram can produce from 14 to 16 thousand kilojoules. Currently, there is increased interest in the area in the Republic of North Macedonia, as it is emerging as an alternative energy for oil derivatives replacement. The manufacturing factories have made significant progress in the use of this table, which provided a wide range of different varieties, lines of pelletizing machines and briquettes. They are characterized by different ways of collecting waste mass, its production, different purchase prices with different capacities. All this makes it possible to choose the right machine according to the conditions and needs of the user.

KEYWORDS: machinery, waste wood, production costs, briquettes.

INTRODUCTION

Briquetting, as well as the production of pellets as a technical and technological procedure aim to compact (thicken) the cut mass at high pressure, thus increasing the bulk density and making the product usable for easier handling and various purposes. In such a procedure, the volume of the table is reduced to 20 times, which in many respects reduces and facilitates the production of the manipulation used. In this way, energy valorization is carried out, which makes it possible to

absorb the available resources that appear every year in agriculture, reducing dependence on petroleum products and as a significant energy source, successfully used to replace them (Martinov & Topalov, 1984).

For this technological procedure, as well as for the products obtained from it, it is characteristic to emphasize the following:

- The existence of large sources of raw materials, which happens every year;
- The average bulk density in briquettes and pellets per cubic meter is 1000-1100 kg and easily makes it convenient for packaging in foil or other practical packaging;
- The calorific value of pellets and briquettes varies from 14 to 18000 kilojoules per kilogram of mass depending on the raw material used, as there are different types of recipes for which raw material and how to use it, which directly affects energy power and its duration.

The heating and use of briquettes and pellets is very practical, as it emits a minimum amount of combustible materials, as well as ash of 2-35%, which is important for environmental protection. They can be successfully used in certain systems in urban areas, as well as in agricultural processing facilities such as greenhouses, greenhouse foils, distilleries and other purposes of existing installed heating equipment, but there are also specialized installations with different automation for their combustion.

MATERIAL AND METHODS

The tests were conducted on the territory of the Republic of Northern Macedonia, with different machines and different variants of raw material for the production of briquettes and pellets. The experiment was created with a line of machines manufactured by NEGRI and a newly built briquette machine of its own design. Spreading and trial work were carried out in different regions, using raw material from wood waste from viticulture, forest waste and sawdust from sawmills.

In order to obtain the necessary data and achieve our goal, we worked with an Italian pellet line manufactured by NEGRI, but also with a newly designed palletized. Vines and fruits cut into hedgehogs were used; raw material from forest waste was used, as well as various disposable saws. With the line of pellet machines, different mixtures are made in different variants with several repetitions, measuring the quality of work, the moisture of the raw material during operation, the total production costs and other operating characteristics. All variants were measured using a

standard methodology and were not statistically processed. During the work we used a moisture meter, electronic scale, stopwatch and other tools and instruments. Analyzing the overall issues, as well as the various ideas that came with the study of this issue, we set ourselves the goal of building a new briquette dispenser. Such a machine is made in four forms and by filling the mixture, which has been soaked in a bowl of water for pressing to a better clamp, i.e. high pressure table for assembly (Šite, 2014).

This machine works with the same options as the line of pellet machines. The difference is that in the production of pellets, the moisture was not allowed to exceed 15% and was expected to dry naturally, which appeared in the period from 15 May to 30 October. When working with the briquette machine, the process lasts almost a year. For all studies and variants, the results obtained are presented in the next chapter.

RESULTS AND DISCUSSION

As the first work process in the production of pellets and briquettes, regardless of which mass is used as the first work process, transportation is performed. It is carried out from different places to the place of processing, or in case the machines are transferred to the place where the raw material is located, if they have their own installation, but the most important point is the current moisture of the raw material being processed. If the briquettes can be treated with different moisture, the raw material must be processed without the need for additional drying, but there is a need to transport the final product. There are costs in both options. This means that transport costs cannot be avoided and are usually carried out with trucks or tractor trailers with different loads, and how many loads will depend on how much mass is ready or the mass is said to be iron or bulk. In all cases of the performed analyzes the transport costs are profitable at a distance of up to 20 kilometers. At a greater distance, the price rises, this directly affects the production price of the final product.

There is a different case of arranging the mass in large transport trucks (iron), which reduces the volume, but also transports a larger mass, which means that the transport unit will be reduced by a ton.

From the results shown in Table 1, it can be seen that the average quantity to be transported at different weights is around EUR 15 per ton. This is an amount that varies and in any case can be smaller or larger, depending on the type of vehicle, which is usually cheaper to transport the tractor

than the truck, the distance to transport and whether it is from the production of grape or orchard table or sawmill waste.

Table 1. Overview of the total cost of eight hours of pellet or briquette production, €

№	Total cost	Grinding machine	Pelletizing machine	New machine
1.	Transport of tonnes of mass	15	/	15
2.	Amortization	8	12	2+8
3.	Fuel	5	5	/
4.	Working hours of the person	20	20	20+20
5.	Manipulation costs	5	5	5
6.	Total	53	42	70
		95		

Table 1 shows the depreciation of pellet and briquetting machines, which shows that for eight hours of operation of the machines for granulation of the line, the depreciation rate is about 20 Euros, and the line briquetting machines are about 10 euro. These calculations are made as a result of all calculations for delivery, maintenance and repair, as well as the calculation of the depreciation fund after 10,000 operating hours. This low depreciation rate occurs as a result of the low purchase price, which means that if the machines are more expensive and with a higher purchase price, it means that there will be a higher depreciation rate, and at the choice of the user may be planned depreciation fund or not.

Point 3 of Table 1 - fuel shows that 5 euro were spent for 8 hours of working time, or plus the Euroline of pellet machines, as both machines are powered by an internal combustion engine with a power of 5 and 7 kilowatts. With an effective operating time of 0.75, the energy consumed in the oil derivatives of these engines is about 10 euro. When working on a briquette production line, about 5 Euros were spent on petroleum products, as the amount of fuel was added only for the grinding machine. Pressing the briquettes did not require additional energy, as the press was manual.

In a well-established organization, the good preparation of the material, the productivity analyzed in Table 2, shows that for one working hour, the knife can chip a different mass, with an average

of 110 kilograms per hour or 880 kilograms for 8 working hours, and the pelletized has the same values, i.e. the same capacity. In this line of machines, when the pelletized is connected, the moisture must not exceed by more than 13% for each type of mass to be treated. If more values are obtained, a new work process is required that dries the pellets before they are packaged for sale.

Therefore, during operation, we measure the moisture content in each mass, as different raw materials have different moisture. However, it is highly variable and depends on the period in which it is carried out after transport from vineyard or forestry waste or sawmills waste. The difference is very large if the transport is done in the winter or in the spring.

During the production of briquettes it is a mitigating circumstance that any cut mass, regardless of moisture, can be transported at any time and the drying of the briquettes is carried out naturally during the summer, without the need to install a dryer and increase costs. .

During the work and in the research itself it is noticeable and special attention should be paid to the raw material that mixes this type of case with the use of vineyards with sawdust waste, different mixtures, different calorific value and different moisture, which is very important for pellets immediately. once the technological process begins, the moisture should not exceed 13%, and according to the measurements and results given in Table 2, in the production of briquettes, the moisture is about 60%, or rather, the mass is immersed in water, thus the briquette is adhesive, becomes hard and when pressed the mass tightens, the water is drained and the briquette contains about 30% moisture. The initial moisture of the produce needs a period of time, most often during the summer, to dry and reach 11% moisture in order to be packaged for sale. Of course, the use of dryers will speed up this procedure, but as we mentioned, it will increase the production cost.

As well as the purpose and significance of the test with this low-performance machine line, it was to analyze all types of costs arising from the overall collection, travel, production of pellets and briquettes, their storage, but also their handling without the use of dryers. The aim was whether the costs presented could be reduced to a certain parameter or not. It was found that in the table itself it is noticed that the machine for cutting a worker can be served and set a price of 20 euro; the same amount is for the pellet machine, which is his daily allowance for 8 hours of working time. From the table itself, a position of 20 + 20 or a total of 40 euro is noticeable, on the line of briquetting machines, where two logs are placed for 8 hours, i.e. one for the grinding machine and the other for the briquetting machine, which is manual.

Table 2. Results of in-line testing of pellet and briquette machines

№	Indicator	Grinding machine	Pelletizing machine	Briquette machines
1.	Productivity per Kg / hour and Productivity for 8 hours	110	110	80
2.	Productivity for 8 hours	820	880	640
3.	Moisture on the material before starting work, %	15	/	60
4.	Moisture on pressed pellets, %	/	11	30

The manipulative cost for 8 working hours is about 5 euro.

If we analyze the results shown in Tables 1 and 2, we can freely conclude that all values have their variability, such as productivity, but also the skill and training of the person himself, because during the work depends on the production, how the table is ready and available, but it depends on the person, the worker with what speed and skill destroys the work process. Hence productivity, because in this case the costs are fixed for 8 hours of working time, but whether it will produce more or less of the above parameters or will reduce and increase the production cost.

As already mentioned, the production of pellets and briquettes can be made from the same table or from a mixture of different tables. All this affects the quality of the pellets and energy power. Typically, pellets produced from viticulture and fruit production are characterized by a calorific value of 10000-12000 joules per kilogram. Similar limits are from forest waste, and slightly higher values are from the woodworking industry. The energy values are shown in Table 3 (Martinov & Topalov, 1984).

Figure 1. Appearance of the made briquettes with of the newly constructed machine

Table 3. Thermal value of the dry substance with optimum humidity of different raw materials

Material	Thermal value, KJ/kg
Straw	13000-14000
Maize	10000-13000
Corn cob	12000-14000
Vine waste	10000-12000
Waste in fruit growing	10000-11000
Forest waste	10000-14000
Wastes in the woodworking industry	13000-15000

Table 3 shows the values of the heat value from different raw materials measured in the apparatus. Calorimetric bomb, but as we mentioned the caloric energy, i.e. the heat from various raw materials is ram, which they give when burned. It is important that different masses have different periods of time of this heat output, which is directly related to the parameter with which the mass for which it gives the energy value and its duration is used. Every year, different scientists, different institutions give new guidelines for improving these parameters, which together with these studies provide a basis and contribution to science and application for further guidance and analysis.

CONCLUSIONS AND SUGGESTIONS

From the data obtained from working with machines for pellets and briquettes, we can draw the following conclusions:

1. The cutting machine, under optimal operating conditions, has a capacity of different mass and raw material of about 110 kilograms per hour or 8 hours during about 820 kilograms depending on the raw material and readiness, the same power has the granulating machine if the content of moisture does not exceed 15%. The briquette machine has a capacity of 80 kilograms per hour or 8 hours of working time 640 kilograms.

2. The cost for 8 hours of working time of the grinding machine is about 53 euro, on a pellet machine 42 euro or together on both machines is 95 euro. The total cost of the briquette machine for 8 hours of working time together with the grinding machine is 70 euro.

3. Working time of the person in production of pellets and briquettes, under optimal working conditions is 8 hours, or 40 euro per day cost.

4. From the studied machines in the course of work, as well as the obtained results, we can conclude that they are characterized by low capacity with high mobility and adaptability of field conditions to work with low costs in the production process. Many of them are suitable for the operation of orders in cooperative associations.

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