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ANALYSIS OF TECHNOLOGIES OF SOWING AND SOWING

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Modern technologies for harvesting hay, silage (combisiloss), haylage, herbal flour and fodder root crops, as well as complexes of machines (mowing machines, rakes, press-pickers, self-propelled and trailed self-propelled forage harvesters, vehicles for transportation of feed and forage harvester machinery for the packaging of feed in polymeric materials) of domestic and foreign production are intended for workers of agricultural and farm enterprises, specialists of the agro-industrial complex, scientific staff and teachers of higher educational institutions, who are issues of fodder production.

The technologies that allow the preparation of hay in the pulp, pressed and crushed form to determine the loss of nutrients and energy in the green mass are analyzed.

Keywords: *harvesting of forages, hay, haylage, grass, humidity, technology.*
Tabl. 1. Lit. 15*.*

Introduction. Harvesting hay is one of the most common methods of canning herbs and is a complex physiological and biochemical process, which is based on drying grass to a moisture content of 17 - 18%. An integral part of any harvesting technology is the complete or partial drying of the grass in the field. This process is accompanied not only by the loss of mowed plants, but also from nutrients as a result of biochemical processes.

Analysis of recent research and publications. To date, a large number of technologies have been developed that allow the hay to be harvested in pulp, pressed and crushed form [1]. Depending on the method of drying the herbs, the developed technologies can be divided into two groups, technologies that involve drying the hay in the field and with pre-drying by active ventilation.

Results and Discussion. Analysis of technology of hay and hay harvesting in order to determine the loss of nutrients and energy in the green mass.Presenting main material. When harvesting the spreading hay with the formation of the honeycombs is multioperational, and therefore labor-intensive and causes significant losses of nutrients that can reach up to 35% [2] The technology involves mowing with or without pounding and peeling in the prickles to the moisture of legumes not lower than 50, and cereals 45%. To accelerate the process of attachment, the grass is shaken. When the specified moisture limit is reached, it is harvested in rolls, in which it is brought to a moisture content of 30 - 35%. After that, the grass from the rolls is picked up with the formation of hoes for further drying. The thus obtained hay are loaded into vehicles, taken to a storage place and placed in a shed.

The technology of harvesting the hay with pre-drying in rolls is more perfect. The grass in the formed rolls is brought to a humidity of 20 - 22%. After which the hay from the rolls are picked up and delivered to the storage place. The main disadvantage of this technology is that the drying of the grass in the rolls leads to a difference in humidity between the upper and lower parts of the roll. Depending on the thickness of the rolls, the difference in moisture between the upper and lower layers can be 2 - 8%. This leads to the formation of mold cells in the storage of hay [3, 4].

The technologies of harvesting the pressed hay of field drying are developed, presuming to compress it into packs or rolls. Each of the technologies includes mowing the grass and uniform drying it. For him, the use of the rolling of rods or the rollover. At humidity 55 - 45% grass is harvested in rolls and dried to the required humidity.

The most commonly used technology for pressing hay harvesting involves drying the grass in the field to a humidity of 20 - 22 or 25 - 30%. In the first case, grass from the rolls are picked up and pressed into packs or rolls, which are stacked in storage. In the second case, the grass is pressed in packs, the density of which does not exceed 140 kg / m3, and leave in the field for 2 - 3 days for drying [3].

Recently, the distribution has received hay harvesting in rolls. The advantage of this technology before hay harvesting in the pack is to more complete mechanization of harvesting, reduce labor costs and cost. Round balers are simpler than design and less energy-intensive than piston [5, 6].

A deterrent factor in the widespread use of hay harvesting technology in rolls is the low humidity of 17-22% of pressed grass. The formation of rolls from raw materials, the moisture content of which exceeds the specified limit, leads to a decrease in the fodder value of the hay. The marked technologies of the pressed hay harvest are characterized by the same drawbacks as the technology of harvesting hay spreading hay.

Preparation of pressed hay of high humidity - relatively new direction in fodder production. The essence of this method of preparation consists in the fact that to suppress the vital activity of microorganisms that are in the vegetable mass, make chemical preparations (preservatives). This prevents damage to the hay during storage.

The disadvantage of this method of harvesting is that when picking up herbs with a moisture above 30%, the effect of preservatives may be unreliable [7].

The technology of harvesting the pressed hay of field drying has a number of advantages over the technology of harvesting hay spreading, since they allow you to reduce the loss of nutrients, both during harvesting and storage of hay and allow more fully utilize the capacity of storage facilities, because the pressed hay in the 1.5 - 2 times more compact than pouring.

The trench technology of high humidity hay harvesting has been developed. The difference between this technology and the harvesting of spreading and pressed hay is

that the 40 to 45% of the grass is bound to moisture when crushed, loaded into vehicles and delivered to concrete storage facilities (trenches) in which the grass, as it receives , sealed and sealed with a polyethylene film and a layer of ground [6].

The disadvantage of this technology is the possible loss of nutrients when depressurizing the storage.

Significantly reduce the loss of nutrients in comparison with the technology of harvesting hay field drying allows active ventilation. This method allows to reduce the period of stay of the mowed grass in the field for 2 - 3 days and increase the collection of hay for 10 - 15% per hectare. With its use, the hay's nutrition increases by 20%, as well as the loss of carotene [8].

When harvesting the spreading hay with pre-drying by active ventilation attached to the humidity of 40 - 45% of the grass is taken out of the field and dried in places of storage on special air distributors by blowing through a layer of grass atmospheric or heated air.

The tied grass is stacked in two steps: the height of the first layer is 2 - 2.5 m, and the second is laid up to the height of the ridge (5-5.5 m) or storage, when the humidity of the first layer drops to 25%. The first 1.5 - 2 days of the mass ventilate continuously, and later only in the afternoon, bringing the hay moisture to 17 - 18%. It should be noted that the drying of the attached herb requires careful monitoring in accordance with the humidity and temperature regimes of ventilation.

When harvesting pressed hay by active ventilation attached to the humidity of 30 - 35% of the grass is picked and pressed in ordinary or shortened packets, the density of which does not exceed 110 kg / m3. The skid from ordinary packs is formed by the type of "brickwork", and shortening packs can be dried in bulk [9].

The disadvantage of drying the pressed hay is that the veneer surface is mostly ventilated. The movement of air in the middle of the pack is insignificant. Because of this, during drying of packed hay, there are cases of mold appearance in the middle of the pack. It is also difficult to determine the period of completion of the ventilation of the stack and readiness for storage.

When harvesting crushed hay by active ventilation, the crushed and grated grass is dried in shed or turret type stores.

In order to prevent the clogging of air distribution systems of ventilation units with particles of crushed grass on them, first lay a layer of crumbled grass thickness of 0.05 - 0.1 m. The thickness of the layer of crushed grass in one loading step should not exceed 2 m.

The following layers are laid after the moisture content of the hay in the upper part reaches 25%. Chopped hay has a good buoyancy, it is easily sealed. The total height of the layer of crushed hay on the ventilation installation with side lattice decks can be up to 6 m.

When drying the hay in the tower storage at first, to facilitate ventilation of the lower layer, in a tower height of 1 - 1.5 m load the grass with a humidity of up to 35%. After that, a layer of height of 5 - 6 m of higher humidity is loaded and

ventilated for 4 - 5 days, and then lay another layer and continue to ventilate the entire mass of the tower. The first 1.5-2 days of hay are dried continuously, and in the following - only in the afternoon. The completion of drying can be determined by the temperature, it should not increase with a long shutdown of the fan [10].

Desiccation of grass by ventilation, even atmospheric air, is a relatively energy-intensive process, because to get one ton of grass hay, which has a humidity of 35-40%, it is necessary to spend almost 120 kWh of electricity. In addition, because of the high humidity of atmospheric air, the daily duration of effective ventilation, in most cases, does not exceed 5-8 hours. An increase in the duration of ventilation by heating air by electric heaters or heat generators leads to an additional cost of 30 to 40 kg of petroleum products per ton of dry hay [10].

In recent years, in order to reduce the cost of energy for heating the air, developed a number of devices that convert solar energy into heat. This can significantly increase the performance of drying equipment without additional energy costs, but due to low reliability and durability these devices are not widely used.

Haylage - a kind of feed, the basis of which is preservation "physiological dryness of the environment", that is, reducing the moisture content of herbs to the limit, which excludes the development of rotting, butyric acid and other harmful organisms.

According to standard terminology [1], haylage is a feed made from herbs collected in the early phases of vegetation and bound to a moisture content of 45-55% and stored in anaerobic conditions.

The technology of hay harvesting involves the following operations: mowing, trimming, picking and crushing grass, packing the mass in the storage and sealing it [10, 11].

After cutting the grass, they instil in the field up to a humidity of 45-60%. In unstable weather conditions it is better to tie the grass in the boreholes, and when stable - in the rolls.

Great success in Europe is the technology of harvesting feed "haylage in the package" [12]. The difference of this technology from the technology of harvesting pressed hay in the rolls is that the rolls are formed at the humidity of the grass 40 - 60%. Not later than 2 - 3 hours the roll is sealed in a special film. When using such technology, feed is maintained for one year without significantly reducing its nutritional value. However, the use of this technology requires additional equipment with the mechanization and cost of the packaging film.

The technology of hay harvesting in mats deserves attention, which includes shredding of green mass, trimming, pressing and drying on a stubble [13]. According to N. Tietz [14], the application of this method allows increasing the hay harvest by 10% (by reducing losses) and increasing the content of raw protein.

From the analysis, it can be seen that no matter what the difference between the technology of hay and hay harvesting, the inalienable stage of any technology is the partial or complete drying of mowed grasses in the field. The peculiarity of this

process is not only the loss of mucilaginous plants, but also of nutrients that can reach a significant size (Tab. 1).

Table 1

Loss of nutrients and energy when lucerne is attached [15]

Length of attachment, hour	Humidity, %		Losses, %		
	incipient	ending	dry matter	protein	gross energy
6	73,3	69,1	1,4	0,9	2,0
72	81,8	49,8	19,5	10,9	10,0

Conclusions and prospects for further research. Modern technologies for harvesting hay, silage (combisiloss), haylage, herbal flour and fodder root crops, as well as complexes of machines (mowing machines, rakes, press-pickers, self-propelled and trailed self-propelled forage harvesters, vehicles for transportation of feed and forage harvester machinery for the packaging of feed in polymeric materials) of domestic and foreign production are intended for workers of agricultural and farm enterprises, specialists of the agro-industrial complex, scientific staff and teachers of higher educational institutions, who are issues of fodder production.

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АННОТАЦИЯ
АНАЛИЗ ТЕХНОЛОГИЙ ЗАГОТОВКИ СЕНА И СЕНАЖА

Рассматриваются современные технологии для заготовки сена, силоса (комбисилоса), сенажа, травяной муки и кормовых корнеплодов, а также комплексы машин (косилки-плющилки, грабли, пресс-подборщики, самоходные и прицепные кормоуборочные комбайны, транспортные средства для перевозки кормов и кормозаготовительная техника для упаковки кормов в полимерные материалы) отечественного и зарубежного производства, которые предназначены для работников сельскохозяйственных и фермерских хозяйств, специалистов системы АПК, научных сотрудников и преподавателей вузов, которые занимаются вопросами кормопроизводства.

Проанализированы технологии, которые позволяют заготавливать сено в рассыпном, прессованном и измельченном виде для определения потерь питательных веществ и энергии в зеленой массе.

***Ключевые слова**: заготовка кормов, сено, сенаж, трава, влажность.*

Табл. 1. Лит. 15.

ANNOTATION
ANALYSIS OF TECHNOLOGIES FOR SOWING AND SOWING

Modern technologies for harvesting hay, silage (combisiloss), haylage, herbal flour and fodder root crops, as well as complexes of machines (mowing machines, rakes, press-pickers, self-propelled and trailed self-propelled forage harvesters, vehicles for transportation of feed and forage harvester machinery for the packaging of feed in polymeric materials) of domestic and foreign production are intended for workers of agricultural and farm enterprises, specialists of the agro-industrial complex, scientific staff and teachers of higher educational institutions, who are issues of fodder production.

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***Keywords**: harvesting of forages, hay, haylage, grass, humidity.*

Tabl. 1. Ref. 15

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