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The Technology of Obtaining High-Quality Seeds of Sugar Beet.

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ABSTRACT

The article deals with a problem of coating sugar beet seeds with nutrient materials. The authors describe the experimental procedure on coating seeds with the proposed composition and give the results of the research.

Keywords: sugar beet, seedbed preparation, results of the research.

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INTRODUCTION

The introduction of intensive technologies of sugar beet cultivation involves increasing requirements to seeds quality and the need to find ways of improving it. Seed quality of sugar beet depends not only on varietal characteristics and growing conditions, but also on seedbed preparation, which includes cleaning seeds from impurities, grinding, calibration, screening according to aerodynamic properties and specific weight, processing with protective-stimulating substances, pelleting and incrustation.

Pelleting seeds provides more uniform sowing, facilitates sowing fine rough seeds (carrot, parsley, etc.), reduces labor costs during crops thinning, economizes seeds, improves plant growth and increases the yield (of beets, onions, carrots, cucumbers, parsley, tomatoes by 20-25%). Pelleted seeds can be stored for 6-9 months without losing germination power [1].

METHODS AND MATERIALS

The composition of the coat includes nutrients (micronutrients, growth regulators) required for starting the growth of plants, as well as some means of protection (against soil and ground pests – insecticides and repellents, and from diseases of seedlings and young plants – fungicides). The advantages of pellets are the ability to achieve maximum precision of seeding when sowing to final thickness. Pelleting also makes it possible to protect seeds at early stages of growth; there is a possibility of additional seed nutrition through pellets; there is no need in such costly field operations as crop treatment with pesticides and herbicides; sowing is convenient, and germination is quick and high.

However, the existing designs of machines for pelleting seeds of sugar beet do not meet the requirements on performance and quality of pelleting. For this reason in FSBEE HE “Penza state agricultural academy” a drum pellet mill with a rotating bottom has been designed, constructed and tested (figure 1) [2].

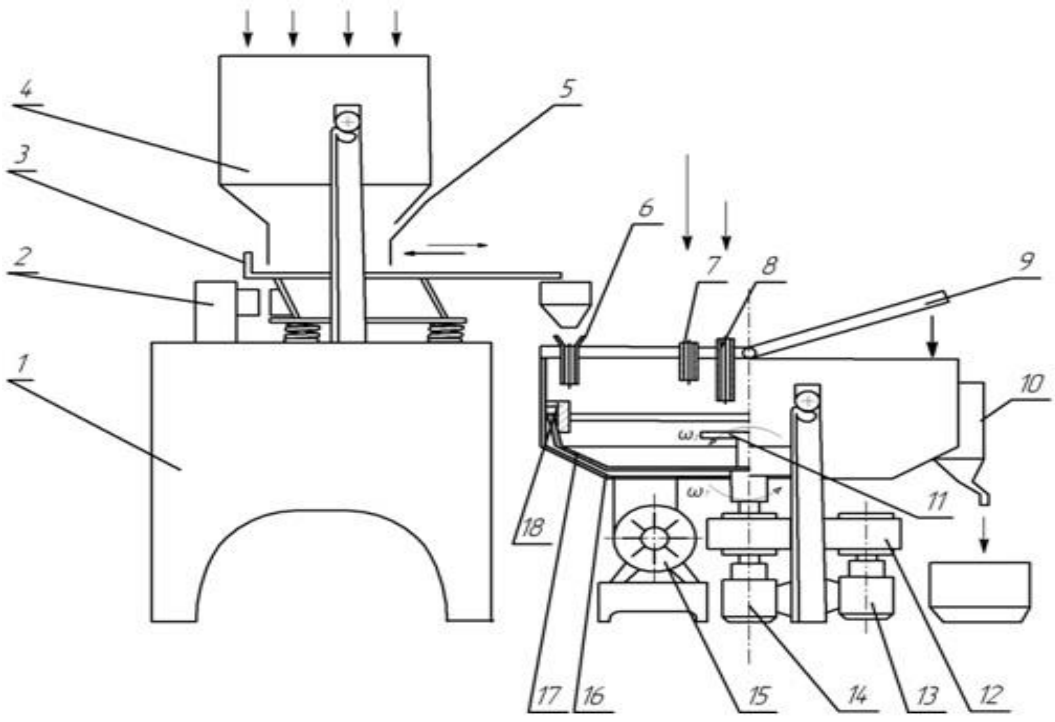

Figure 1 – Technological scheme of the drum pellet mill:

1 – frame; 2 – starting device; 3 – vibrating chute; 4 – measuring hopper; 5 – valve; 6,7,8 – holes in the lid of the drum; 9 – upper hatch; 10 – unloading hatch;11 – rotating disk (spindisk);12 – reducer; 13 14 – electric motors; 15 – fan; 16 – drum of pellet mill; 17 – rotating bottom; 18 – divider

The sequence of the conducted experiments was as follows. A dry composition for pelleting of seeds (coating powder) consisting of micro - and macro-fertilizers, vitamins, growth regulators, is loaded into the measuring hopper located on the frame. From it the composition enters the drum of the pellet mill through the hole. Delivering the composition for seeds pelleting is regulated by the valve and with the help of vibrating chute, the frequency of which is determined by the starting device. The seeds prepared beforehand are loaded into the drum of pellet mill through the top hatch, and then the hatch is closed. The fan of blowing in the pellet mill is switched on with starting station. Further, through the electric motor the bottom of the drum is activated. The bottom of the drum in the drum pellet mill is made of rubberized material and has the shape of a truncated cone with a large base up. The frequency of rotation of the drum bottom is regulated by frequency inverter by method of stepless regulation. Then through the motor drive, the divider of the adhesive solution (the operating fluid) is started, the divider of the adhesive solution having an undulating surface for better spray of the flow of the adhesive solution. The divider rotates at a speed ω2, and the rotation direction can be regulated. The adhesive solution (the operating fluid) flows from the volumetric container through the hole in the lid of the drum of the pellet mill.

The supply of the working liquid (adhesive solution) and pelleting powder is carried out alternately and continuously to obtain pellets of the required dimensions and meet the requirements of the standard.

At steady state rate of pelleting at the stage when 3/4 of the powder is supplied the protective means complex (insecticides) is supplied in the form of dry powder through the hole in the lid of the drum of the pellet mill.

When rotating the bottom of the pellet mill drum the seeds move from the center to the sides of the drum due to centrifugal forces, they move on it, and then meet with the divider, which sends them to the center of the pellet mill drum. Thus, the seeds perform complex motion (translational and rotational) and they are intensively mixed. The cycle repeats several times until the seeds are completely covered with a coat of pelleting components. Then dye is added to the pellet mill drum. Thereafter, rolling is conducted for several minutes to compact the coat. At the end of pelleting process unloading of ready seeds is carried out through the unloading hatch. [3].

The composition of pellet mass for application to seeds is shown in Table 1

Table 1– Pellets composition

No.	Components	The content of a mass fraction in percent
1	Treater	0,15
2	Furadan	0,30
3	Perlite powder	30
4	Bentonite clay	18
5	Pure skin glue	1,0
6	Beet seeds	50
7	Pigment red 5C	0,55

Quality of processing seeds in drum pellet mill depends on many factors. That is why the research was conducted with the help of planning methods of multi-factors experiment [4] on sugar beet seeds of Zemes hybrid.

EXPERIMENTAL PART

Seed quality after release from pellet mill (% of quality seeds) was taken as the criteria of optimality of the process. On the basis of a priori ranking the following key factors:ω1 were selected: the frequency of rotation of the working body (bottom of drum), D and h – diameter and height of the drum, mm; V – the

degree of loading of the drum, %; t – the time spent on the pelleting, min; d and b – the diameter and height of the rotating disk, mm; t1 – the duration of the supply of adhesive solution, minutes. After processing the results unimportant factors were excluded from further consideration.

The results of multivariate experiment were processed on ECM using Excel 2003 and Statisticav.6.0 programs. Three most important factors were revealed: ω_1 (x_1);V (x_2); t (x_3). There obtained adequate mathematical model of the second order describing the dependence $P = f(\omega_1; V; t)$ in decoded form:

$$Y=11,72197+0,15922\,\omega_1 - 1,86435V - 0,58422t - 0,00007\,\omega_1^2 - 0,51977V^2+0,01823t^2+0,00421\,\omega_1 V - 0,00051\,\omega_1 t+0,06465Vt.$$

To describe the response surface by the equation of the second order the central composite orthogonal planning of the second order was used, it is characterized by simplicity and ease of calculations (quite economical in the number of experiments). On the basis of processing the experimental data the probability curves were made. The analysis of probability curves showed that the maximum quality of seed pelleting $P = 96...98\%$ can be achieved at ω1=1100...1300 min-1,V= 3,5...5,5% иt= 18..32 min[5]. Seed quality depends on the amount of fluid applied to the seeds. To determine the optimal ratio λ of the glue and sugar beet seeds by mass, a multi-factor experiment was conducted, the results of which are graphs. According to it under λ= 1,2...1,3 98-99% of the seeds are pelleted. When reducing λ not all seeds are pelleted, and when increasing λ the number of double and triple seeds in one pellet increases (the seeds stick together).

The authors have also studied the effect of the number of dividers on the quality of the seeds (Fig. 4). It turned out that if four dividers are installed about 98% of the seeds is of high quality. When the number of dividers is reduced not all seeds can be processed with fluid, and when the number of dividers is more than four there is increase in the number of double and triple seeds in one pellet (the seeds stick together).

CONCLUSIONS

It can be concluded that the drum pellet mill with the rotating bottom provides 96-98% pelleted seeds on the level when its productivity is при его производительности three downloads for 1 hour [6].

REFERENCES

[1] Galiullin. Sh. R. The development of resource-and-energy-saving technologies and technical means for industrial processing seeds of sugar beet: Dis. ... d-r techn. sciences. – Kazan, 2004. – 414 p.

[2] Kukharev, O. N. The results of studying the drum pellet mill / O. N. Kukharev, I. N. Semov, A. M. Chirkov // Niva Povolzhya . – 2010. – No. 1 – P. 54-57.

[3] Pat. NO. 97238 EN U1МПК A01C 1/00. Apparatus for pelleting seeds / O. N. Kukharev, I. N. Semov, A. M. Chirkov.; applicant and patentee FSBEE HPT Penza state agricultural academy Application No. 2009119789/13 Applied 25.05.2009. Publ. 10.09.2010, bull. No. 25. – 3 p.with illustrations

[4] Kukharev, O. N. The efficiency of using drum pellet mill with a rotating bottom / O. N. Kukharev, I. N. Semov, A. M. Chirkov // Tractors and agricultural machines. – 2011. No. 9. – P. 34-36.

[5] Laryushin N. P. Mechanization of the technological process of pelleting sugar beet seeds (monograph) / N. P. Laryushin, O. N. Kukharev, I. N. Semov, A. M. Chirkov // Penza: 2012. – 102 p.

[6] Kukharev, O.N. Quality of seeds pelleting in the pellet mill with rotating bottom / O.N. Kukharev, I.N. Semov, A.M. Chirkov // Tractors and farm machines.– 2011. –№ 1. – P. 10-12.