Annali d'Italia
Scientific Journal of Italy

ANNALI D'ITALIA
SCIENTIFIC JOURNAL OF ITALY

2020 (14)
VOL.1

№14 2020

Annali d'Italia

VOL. 1

ISSN 3572-2436

Annali d'Italia (Italy's scientific journal) is a peer-reviewed European journal covering top themes and problems in various fields of science.

The journal offers authors the opportunity to make their research accessible to everyone, opening their work to a wider audience.

500 copies
Annali d'Italia
50134, Via Carlo Pisacane, 10, Florence, Italy
email: info@anditalia.com
site: https://www.anditalia.com/

CONTENT

BIOLOGICAL SCIENCES

EARTH SCIENCES

MEDICAL SCIENCES

PHARMACEUTICAL SCIENCES

PHYSICAL SCIENCES

TECHNICAL SCIENCES

5. Сігов Б.О. Підвищення точності роботи цифрового інтегратора, побудованного на основі дільника частоти / Сігов Б.О. Автоматика, Київ. 1963, № 1, С. 39-54.

6. Херн Д. Компьютерная графика и стандарт OpenGL / Д. Херн , М. Бейкер; пер. с англ., Москва: Издательский дом "Вильямс", 2005, 1168 с.

7. Ян-Си-Зен. Определение максимальной погрешности двоичного умножителя / Ян-Си-Зен. // Автоматика и телемеханіка, I960, № 7, С.1007-1014.

8. Meyer M.A., Gordon B.M. Pulse-Rate Multipler. Patent 2910237 USA, Filled Dec. 5, 1952, Patented Oct.27, 1959.

WAYS TO INTENSIFY THE COLLECTION SEED OF HERBARES

Spirin A.,
Ph.D., Associate Professor
Tverdokhlib I.,
Ph.D., Associate Professor
Omelianov O.,
assistant
Vovk V.
graduate student
Vinnytsia National Agrarian University, Vinnytsia

Abstract

The main technical means for harvesting grass seeds are combine harvesters. But significant differences in the physical and mechanical properties of the seed heap from cereals complicate their work, especially the operations of wiping and separation of seeds. This encourages the search for seedlings to search for and develop new technological and technical solutions for the processes of threshing, wiping and separation of seeds in the field and in the full-time department.

One of the main problems in threshing and wiping the seed heap is the need to recycle the mass to increase the yield of pure seeds. One of the options to reduce the recycling of material in the thresher of the combine is to refine the design of the threshing machine and air-sieve cleaning, which are described in the work.

The results are stated of the research on substantiation of rational modes of operation of technical means at harvesting of seeds of perennial grasses.

The results of research on the process of harvesting grass seeds by combine harvesters reveal the need to intensify the process of wiping the seeds with a threshing machine. One way to solve this problem is to reduce the degree of contamination of the seed heap with straw impurities.

Keywords: combine harvester, harvesting technology, vibrating grille cleaning, threshing machine

Formulation of the problem. For harvesting legume seeds are mainly used combine harvesters, which are the main technical means. Since there are no special machines for harvesting seeds of perennial legumes, all known technologies are based on the use of combine harvesters. As an object of processing, grass seeds have a number of specific features other than cereals in the structure of plants, inflorescences and seeds, which causes significant differences in physical, mechanical and technological properties of the material being processed. Significant differences in the physical and mechanical properties of the biological mass of grass seeds from cereals complicate the process of seed collection and especially the operation of wiping and separation of seeds with a combine thresher. To harvesting grass seeds, combine harvesters use special devices (adapters), which are more suitable for working with such material as a pile of grass seeds. This reduces losses, but still seed losses remain significant and amount to 20-30% of the biological yield.

The process of wiping seeds from beans remains a problematic issue in the work of threshing machines of grain harvesters, the percentage of wiped seeds after passing through the threshing machine is only 45-55%. Therefore, to wipe the rest of the seeds from the beans, the fraction of ungrained seeds is fed into autonomous graters, the efficiency of which is too low, for one pass of material through the grater wipes only 10-15% of the seeds. In addition, due to the low adaptation of air-sieve cleaning to work with a heap of grass seeds, a significant part of straw impurities and chaff is fed into the grater device with not wiped seeds. Repeated feeding of the same material in the grater device for re-wiping the seeds from the beans leads to the recirculation of the material in the thresher of the combine. This leads to overloading of the working bodies of the thresher, and even greater deterioration of the air-sieve cleaning, and, accordingly, to an increase in the loss of seeds behind the threshing machine of the combine. Significant seed losses during the harvesting of grass testicles lead to the need to find and develop new technological and technical solutions for the processes of threshing, wiping and separation of seeds in the field and in the full-time department.

Analysis of recent research and publications. The issue of development of technologies and means of mechanization of harvesting seeds of perennial legumes was paid attention in [1, 2, 3], but it should be noted that these results have significant contradictions and are in the nature of DCR and GDR and do not provide answers on how to reduce seed losses based on the actual production capacity, given the technical means

currently available in farms for harvesting. on-seeds of perennial legumes.

The purpose of research. Substantiate the basic principles (approaches) of the choice of technological processes (operations) and technical means of threshing, wiping and separation of seeds and rational modes of operation of technical means for harvesting legume seeds.

Research results. According to the results of research on the work of threshers of grain harvesters "Don-1500", KZS-9 "Slavutych" on harvesting seeds of perennial legumes, it was determined that from the total mass of material entering the threshing machine of the combine, after threshing for cleaning receives 64.4-68.5% of the material.

Depending on the percentage of unwashed beans, chaff and straw impurities in the material fed from the air sieve to the re-threshing, the recirculation load on the sieve increases due to the part of the material that is fed to the grater.

The amount of recirculation k_n and the number of cycles n_r re-supply of material for air-sieve cleaning depends on the completeness of wiping the seeds in the threshing machine and grater, the fractional composition of the heap, the technological reliability of the separation of the heap in air-sieve cleaning. Studies of the quality of PST-10, PST-8, and 54-108A graters showed that the use of these devices on combine harvesters for wiping the seeds of perennial legumes allows to increase the percentage of wiped seeds in the hopper by only 10-15%, but to solve the problem of completeness of wiping the seeds with a thresher harvester is not possible. This only leads to an increase in the circulating load on the working bodies of the thresher, and especially the sieve state of cleaning.

Therefore, there is a need to select such modes of operation of the combine thresher, which would minimize the recycling of material in the combine thresher, thereby improving the conditions of air-sieve cleaning during heap separation, and thus minimize the loss of seeds behind the thresher.

One of the options to reduce the recirculation of material in the thresher of the combine is to refine the design of the threshing machine and air-sieve cleaning. In this direction we carried out such works, as a result of which adapters to the "Don-1500" grain harvester were developed. The development envisages an increase in the exposure of the material processing in the working gap of the drum-deck due to the overlapping of the part of the deck with blind inserts with an active working surface. Replacement of the lower louver sieve with a flat piercing sieve with a hole diameter of 2.5-3 mm, which allows for one pass of the material on the sieve to separate the productive seed part of the crop from plant residues. Due to the completion of the design of the fan blade drive, the operating modes of the fan have been changed, which makes it possible to reduce the fan blade speed to 350-400 rpm.

The results of laboratory field research of the thresher of the grain harvester "Don-1500", equipped with adapters for wiping the seeds are shown in Fig. 1,2.

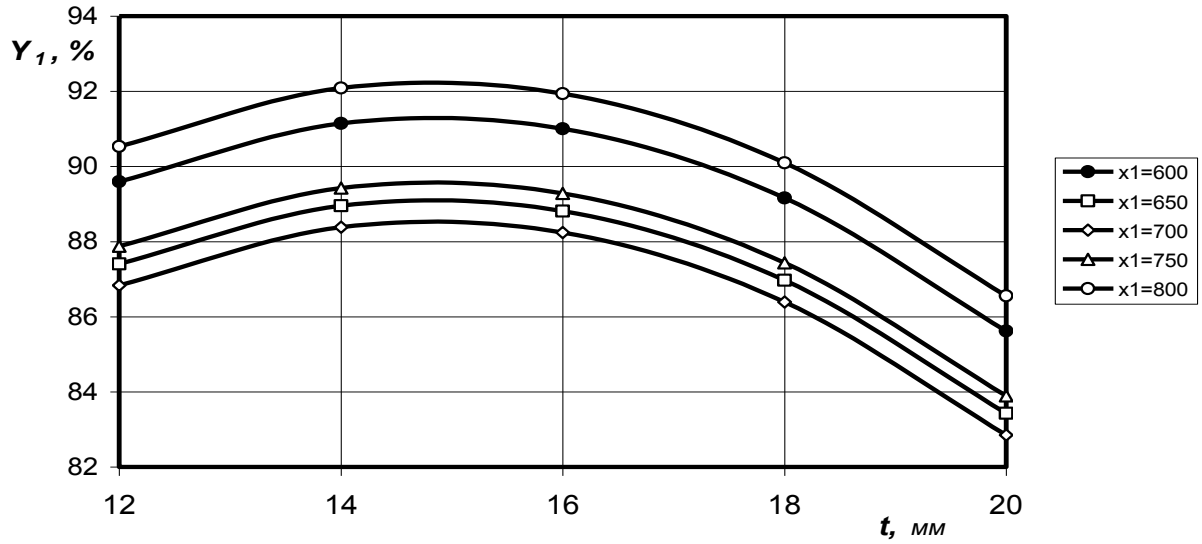

Fig. 1. Dependences of the influence of the working gap h and the speed of rotation of the drum X_1 on the completeness of wiping the seeds μ

Laboratory-field studies of the performance of the combine harvester "Don-1500", equipped with adapters for harvesting seeds of perennial legumes, were conducted in the field on the following agricultural background: humidity of plant mass in rolls 14-19%; seed yield of 2.5 kg / ha with a ratio of seed weight to plant weight on average 1:12. The study was performed at a speed of the threshing drum in the range of 600-800 rpm. Working gaps between the deck and the drum were set at the entrance 12-20 mm, at the exit 4-8 mm; fan blade speed 300-500 rpm; feed material into the combine thresher 3-4 kg/s.

From fig. 1 shows that the maximum completeness of wiping the seeds from beans with a threshing machine with a converted deck is 91,4-92,6%. Increasing the working gap between the deck and the drum at the entrance from 12 to 20 mm affects the completeness of wiping the seeds in the range of 5,2-5,6%. Changing the speed of the threshing drum from 600 to 800 rpm also has a negligible effect on the completeness of seed wiping - in the range of 4,0-5,2%.

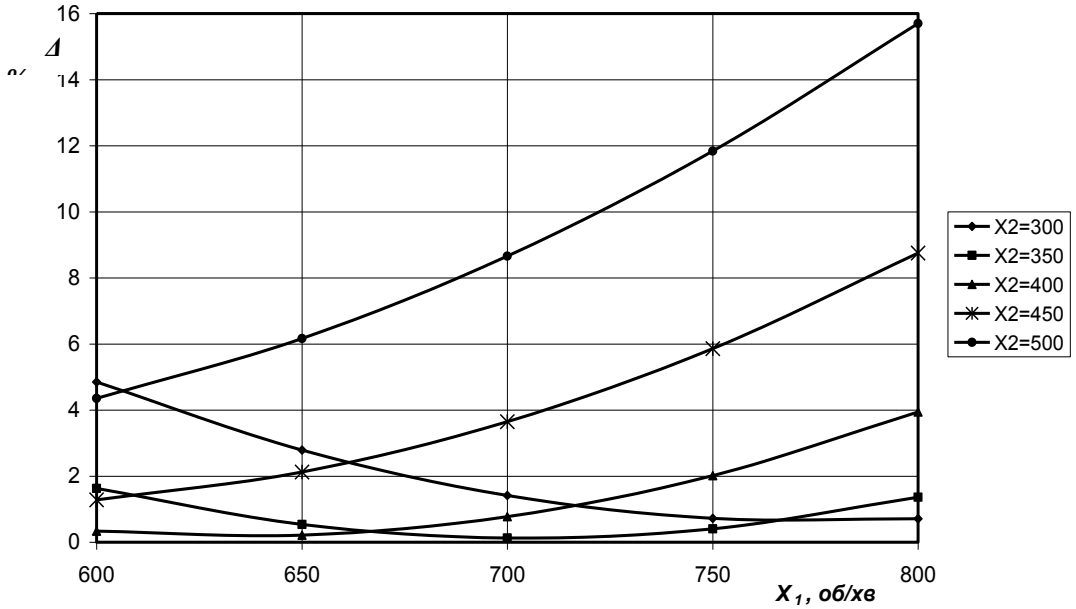

Fig. 2. Dependences of seed losses Δ on cleaning of the combine on frequency of rotation of a drum X_1 and a wing of the fan X_2

Results of researches of work of air-sieve cleaning of the combine "Don-1500" with the reduced frequency of rotation of a fan wing to 300-500 rpm. and equipped with a lower penetrating sieve are shown in Fig. 2.

From Fig. 2 shows that the losses of clover seeds after cleaning the combine with increasing speed of the fan blade above 450 rpm increase sharply.

Thus, at a fan speed of 500 rpm seed losses are already 4,3-15,6%. The magnitude of seed losses after cleaning the combine is also affected by the mode of operation of the threshing drum. With more "hard" modes of operation of the threshing machine – reduced working gaps between the deck and the drum to 12-14 mm and its speed more than 700 rpm – seed losses are reduced by 9-10% due to the completeness of wiping the seeds from the beans. It is also noted that with a decrease in the speed of the fan blade to 300 rpm, the clogging of the hopper heap increases by 12-16% and the process of heap separation deteriorates.

The results of laboratory field research of the threshing machine of the combine "Don-1500", equipped with experimental adapters, are confirmed by the production inspection of its work on harvesting alfalfa seeds, white clover, clover. In production conditions, the use of the "Don-1500A" combine harvester, with adapters developed by us for harvesting perennial legume seeds, allows to ensure complete wiping of seeds from beans 91,4-92% and reduce seed losses after cleaning the combine to 3-5% [4].

Another technological solution for harvesting grass seeds may be the option of harvesting the seed part of the material in the field, followed by doving and separation of seeds in the hospital [5]. In this case, it is possible to reduce the loss of seeds in the field, but there is a need to justify the degree of contamination of the seed heap, as straw impurities, and the content of unworn seeds. Depending on the clogging of the seed heap, the losses of seeds behind the combine, as well as the conditions of its processing at the hospital will change. Deficit of machines for dosing and loading material into the technical means at the hospital, as well as the lack of special machines for working with clogged seed heap leads to a significant increase in labor intensity and reduced productivity of machines for wiping and separating seeds. In addition, the efficiency of machines that can be used in these operations is low, both in terms of quality of work and the reliability of the technological process [6]. Therefore, the use of this variant of technology can be both economically and technologically unjustified. The expediency of using such an option will be determined to a large extent by the degree of clogging of the seed heap, both straw impurities and the content of undried seeds in it.

Therefore, taking into account the possibility of using this option of collecting grass seeds, we conducted studies of the impact on the quality of the sieve condition of grain cleaning machines clogging of the clover heap with straw impurities and the maximum possibilities of using sieve mills on this material and identified rational kinematic modes of sieve operation.

The research was carried out on a sieve state with the amplitude of oscillations of the sieve 7,5-10 mm, and the angle of the sieves 6-8º. The amplitude velocity of the sieve oscillations varied in the range of 0.19–0.40 m / s, the amplitude acceleration of the sieve oscillations varied in the range of 5,0–20,8 m/s^2. The working length of the sieve was 1580 mm. During the research, a heap of clover was used with a contamination with straw impurities in the range of 2-25%. The supply of material to the sieve state was in the range of 500-900 kg/h.

The results of studies of the process of separation of the clover heap with different clogging with straw impurities are shown in Fig. 3, 4. Separation of clover seed heap clogged with straw impurities from 2-5% yielded positive results of technological efficiency and reliability of the separation process. From Fig. 3 it is seen that at optimal kinematic modes of operation of

the sieve state - the amplitude velocity of the sieve oscillations is 0,25-0,27 m/s, or the amplitude approach of the sieve oscillations is 8,5-9,5 m/s^2 it is possible to allocate 98,5-99,5% of straw impurity from a heap, losses of seeds at the same time do not exceed 1,0%.

It should be noted that a decrease in the amplitude velocity of the sieve state from 0,23 to 0,19 m/s, or an increase from 0,29 to 0,355 m/s leads to a 2-5% increase in seed loss and a decrease in the purity of the purified seed.

When separating clover seed heap with a maximum clogging of up to 15-20% with straw impurities, the technological efficiency (Fig. 4) and the reliability of the separation process at the sieve state of grain cleaning machines significantly deteriorates. The speed of movement of particles in the heap layer and on the sieve decreases by 1,5-2 times, the sieving capacity of the sieves falls, the separating heap hangs on the sieves, there are frequent technological failures. The capacity of the sieves is reduced by 2-3 times. Seed losses (Fig. 4) increase significantly and reach 10-12%.

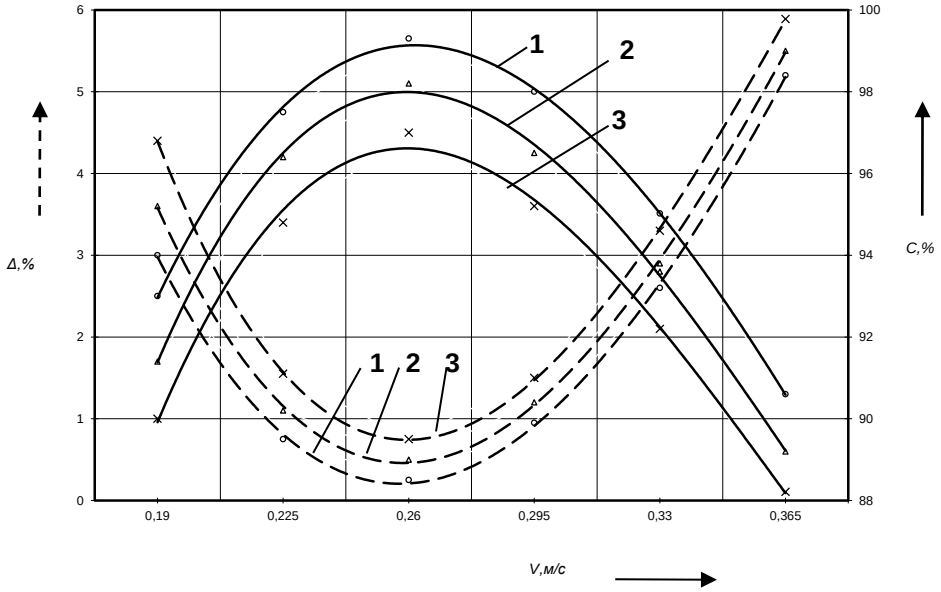

Fig. 3. Graphs of dependences of seed losses on the sieve state Δ and the percentage of release of straw impurities from the heap of clover C from the amplitude velocity of oscillations of the sieve V and clogging of the clover heap with straw impurities: 1-2%; 2-3%; 3-5%

As can be seen from Fig. 3, 4 when separating the heap clogged with up to 15-20% straw impurities, the amplitude rate of oscillations of the sieve state must be increased by 0,07-0,08 m/s in comparison with the separation of the heap, which is clogged with only 2-5% straw impurities.

The difference in the optimal amplitude velocity and acceleration of the oscillations of the sieve state with different clogging of the seed heap is due to the fact that to move the less loose heap there is a need to increase the frequency of oscillations of the sieve state. In addition, from Fig. 3, 4 it is seen that the deviation of the amplitude velocity of the oscillations of the sieve state from the optimal values leads to a decrease in the technological effect of separation. The purity of the cleaned seeds is significantly reduced and the losses due to the sieve condition increase.

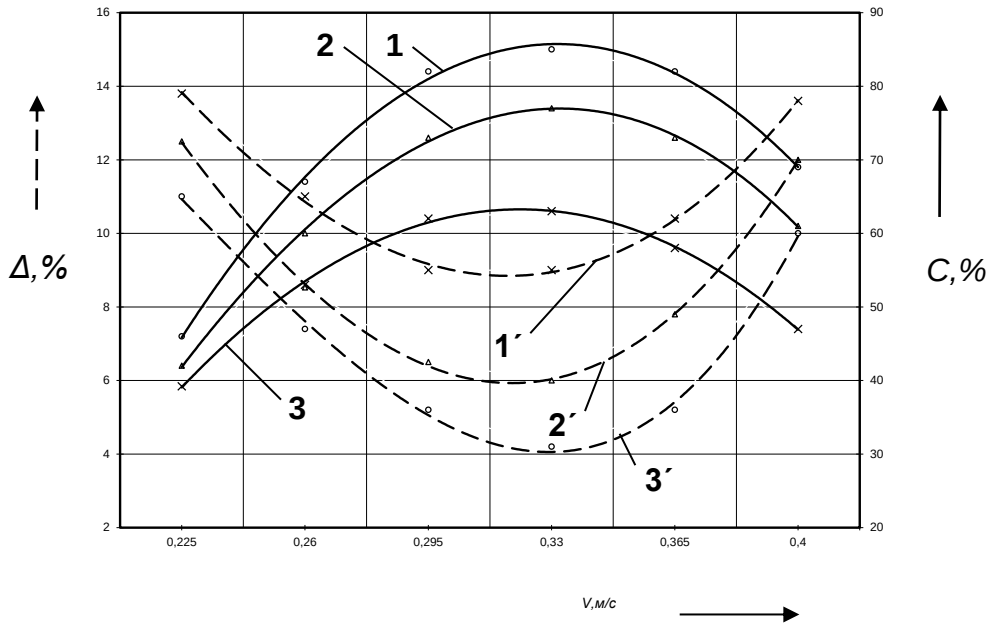

Fig. 4. Graphs of dependences of seed losses on the sieve condition Δ and the percentage of straw impurities from clover heap C on the amplitude velocity of sieve oscillations V and clover heap clogging with straw impurities: 1-15%; 2-20%; 3-25%.

Conclusions. Given the above results of research on the threshers of combine harvesters and stationary wind turbines and based on the technological capabilities of their work on threshing, wiping and separation of grass seeds, appropriate technological decisions can be made to justify the process of harvesting seeds of perennial legumes and rational modes their work.

The results of research on the process of harvesting grass seeds by combine harvesters indicate the need to intensify the process of wiping seeds with a threshing machine and reduce the fan speed to 300-350 rpm and replace the lower louver sieve with a flat punch sieve.

The main factor of technological efficiency and reliability of the process of seed cleaning on the sieves of grain cleaning machines is the degree of clogging of the seed heap with straw impurities. With an increase in the content of straw impurities in the technological material by more than 15%, the efficiency of the sieve decreases sharply, so the use of sieve mills on such material is not appropriate.

References

1. Spirin A.V., Tverdokhlib I.V. Promising technology for harvesting grass seeds. Machinery, energy, transport of agro-industrial complex. 2016. № 1. P. 25-27.

2. Tverdokhlib I.V., Spirin A.V. Technologies for harvesting grass seeds. Feed and feed protein: XIII int. Science. Conf., December 15, 2015. Vinnytsia: Institute of Feed and Agriculture Podillya NAAS of Ukraine, 2015. P. 51-52.

3. Lomakin S.G., Berdyshev V.E., Gusev A.P. Harvesting of clover testicles using combine harvesters. Bulletin of the VP Goryachkin Moscow State Agroengineering University. 2012. №1 (52). P. 30-34.

4. Tverdokhlib I.V., Kuzmich A.Y., Ashlyak M.M. Substantiation of the modes of operation of the combine harvester thresher on seeds of perennial grasses. Collection of scientific works of Vinnytsia National Agrarian University. Series: Technical Sciences. Vinnytsia: VNAU. 2012. №10. T.2 (59). P. 40-43.

5. Tverdokhlib I.V., Spirin A.V. Theoretical studies on the working capacity of disk devices for grinding agricultural crop seeds. Inmateh. Agricultural Engineering. Bucharest: National Institute of research development for machines and installations designed to Agriculture and food industry. 2016. Vol. 48. No. 1/2016. P. 43–52.

6. Spirin A.V., Tverdokhlib I.V., Vovk V.Yu. Vibro conveyor for loading a grater device. Sciences of Europe. 2020. Vol. 2, No 51. P. 40-45.

№14 2020
Annali d'Italia
VOL. 1

ISSN 3572-2436

The journal is registered and published in Italy.
Articles are accepted each month.
Frequency: 12 issues per year.
Format - A4 All articles are reviewed
Free access to the electronic version of journal

500 copies
Annali d'Italia
50134, Via Carlo Pisacane, 10, Florence, Italy
email: info@anditalia.com
site: https://www.anditalia.com/