

УДК 631.3.004

## METHODS OF SUBSTANTIATION OF GRAIN CROPS HARVESTING OPTIMAL DURATION

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**Keywords:** technological process, productivity, grain crops, agronomic terms, harvesting duration, grain losses, harvesting equipment, technical state.

### Resume

The analysis of scientific studies of relationship between grain crops productivity and harvesting time is presented. Various methods of optimal harvesting duration determination are offered.

**Introduction.** When carrying out the technological process of crops harvesting in optimal agronomic terms it is possible to get the maximum quality crop. The optimal duration of harvesting may be organized on economic indices based on technical condition of harvesting machinery.

**Problem.** While projecting technological process of grain crops harvesting two contradictory requirements arise: firstly it is necessary to reduce the duration of each operation, secondly it is necessary to increase the duration of each operation to improve machines exploitation.

**Analysis of the latest researches and publications.** A great number of works on the agrotechnical requirements substantiation for grain crops harvesting has been conducted by different scientific research organizations [1,2]. Substantiation methods of agrotechnical requirements for grain harvesting crops have been investigated [3,4,5]. However, these studies do not include recommendations on how to ensure grain crops harvesting in optimal time period with minimal harvest losses.

**Aim of researches.** Determination of the optimal duration of harvesting and other agricultural activities according to minimal reduced and exploitation expenditures of technological systems.

**Results of researches.** The dependence of grain crops productivity from terms of harvesting in different agricultural zones has been investigated. Since the period when the

standing crop harvest changes a little and is poor in different areas of Ukraine ranges from 6 to 10-12 days.

It is important to define the beginning of grain cropsharvesting. It is necessary to bear in mind the heterogeneity of grain ripening. Ripening uniformity depends on many factors: landscape, weather conditions, biological characteristics of grain varieties, seed quality etc.

As early crops harvesting, and late harvesting leads to grain yield shortfall, which in some years may attain considerable size. At harvesting on the 10thday after reaching full maturity in this research yield losses reached in years 1 to 5.3 kg / ha, while harvesting on the 30th day after ripeness loss increased to 6 kg 5,3- / ha. Loss of grains of different varieties of winter wheat at harvesting on 10thday after reaching full maturity range from 1 to 8 kg from 1 ha, and at harvesting on 30th day - from 3.2 to 12.6 kg .

Table 1 indicates the effect of harvesting period on yield of winter wheat and its losses data of.

Table 1 Effect of the harvesting term on yield of winter wheat

Indicators	Harvested in the beginning of full maturity (1-6 / VII)	The duration from the beginning of full maturity , days		
		1-5	6-10	11-15
Average yield , kg / ha	44,0	42,8	40,7	39,4
Grain humidity, interest	45,0	42,1	40,3	37,4
Harvest at 14% humidity, kg / ha	41,8	41,3	39,6	38,8
The loss compared to the beginning of harvesting, kg / ha	-	0,5	2,2	3,0

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Late harvesting not only reduces the harvest, but also reduces its quality. Reduce of harvest in late crop harvesting is taken into account with a mechanical manner losses (grain shattering on root, grain loss and ear during workflow of cutting apparatus, harvester thresher, etc.). The value of crop losses depends on many factors: the features of the variety, weather conditions, agricultural technology, methods and harvesting terms.

Along with the mechanical losses physiological losses associated with a decrease in dry matter accumulated in the grain indicate reduce of grain yield. Physiological loss at late harvesting 2 times exceed the mechanical losses and make depending on the terms of the harvesting from 1.9 to 2.7 centner / ha. This same losses are observed in the cut grain in swaths.

We know that the actual dynamics of crop harvesting differs significantly from the standard. Since the harvesting of normative duration of 10-12 days, the actual duration of the harvesting is two, and sometimes three times longer, that increases to 20-30 days. Reducing of harvesting terms is solved in different ways and methods. It is proposed to reduce the harvesting duration by increasing the number of combine harvesters in 7-10 % of the standard.

This applies for harvesters of relatively old models (SC -5M "Niva", etc.), whose performance for 1 hour of operating time for harvesting crops is 0,6-0,7 hectares. In determining the impact of new models of combine harvesters into reducing the duration of harvesting grain, normative and actual dynamics of harvesting effect varies.

For example, using the same number of harvesters SK -5M and "Don -1500B ", the reduce of the length of harvesting using harvesters "Don -1500B ", 3.5 times longer than using harvesters SK -5M .

The research results of the duration of harvesting crops influence on biological value of grain losses in southern Ukraine indicated that biological and mechanical losses of grain on average in all cultures make up about 30 kg / ha for each day of delay, or 0.00046 kg to 1 kg of grain yield for each time of delay.

Biological values of grain losses indicate that imperceptible at first sight losses provide immensity when evaluating grain production of farm, district, region and the whole area.

Execution of field work in optimal conditions only in terms of South steppe zones will increase the productivity of crops by an average of 30%.

Determination of the optimal duration of farm operations may be explored by different ways: on the criterion of minimum operating costs per unit of output, on the criterion of net income, which is regarded as the difference between cash crop assessment and production costs depending on the amount and cost of equipment, on economic criteria – dependence of grain loss from the grain mass feed, stand characteristics and duration of harvesting.

Also as optimization criteria of terms grain harvesting except minimum and reduced operating costs for harvesting and transport complexes consider losses from natural grain losses, losses of grain by Reapers and threshing machine, the cost of engineering transport and low quality grain.

The most effective way to determine the optimal length of harvesting is use as a criterion of optimization - adducted costs. It is necessary to know the area of planting, productivity, purchasing prices, shift duration, coefficients for renovation, current and capital repairs. Also additional conditions and restrictions are introduced.

**Conclusions.** The research analysis leads to the conclusions:

- grounding agronomic requirements for harvesting should keep in mind the change of climatic conditions of growing and harvesting crops and their level of productivity and intensity of grain loss;
- grounding optimal duration of harvesting it is necessary to investigate, depending on the rate of readiness of fields for harvesting, the volume of grain production and daily performance of harvesting machines;
- grounding technical assistance of harvesting process must be carried out according to the agrotechnical requirements of crops harvesting.

## REFERENCES

1. Vitvitskyi V.V., Bosyi M.A. Economic aspects of determining of the cost of agricultural machinery operation // agro-industrial production productivity. - 2007. - №6. - P. 89-93.
2. Korenev G.V., Tarasenko A.P. Progressive Methods of harvesting and struggle with the crop loss. - М.: Kolos, 1978. - 175 p.
3. Machines for grain and industrial crops harvesting/ Kravchuk V.I., Melnyk YU.F. . - 2009. - 296 p.
4. The ratios of cost of living and materialized labor on crops production/ V.V. Vitvitskyi, P.M. Musyka, M.F. Kysliachenko, I.V. Lobastov. - К.: RI "Ukragromproductivity", 2010. - 352 p.
5. Dutchenko Z.YA., Glushchenko L.T. Dependence crop and grain qualities from terms and ways of harvesting // Grain crops. - 1990.-№4. - 19 - 20.

6. Optimization of machines complexes and tractor fleet structure / I.I.Melnyk, V.D.Hrechkosii, V.V.Marchenko. - K. : Iss. Center NAU, 1998. - 83 p.
7. Zhukov V., Komarov M.K. The struggle with the grain loss at harvesting. - M. : Rosselhozyzdat, 1981. - 144 p.
8. E.A.Lysunov Optimization of grain crops harvesting duration // Bulletin of agr.science. - 1985. - №10. - P. 147-151.
9. V. V.Marchenko The mechanization of processes in crop-growing: Educational aid. - Kyiv: Condor, 2007. - 334 p.

## **МЕТОДЫ ОБОСНОВАНИЯ ОПТИМАЛЬНОЙ ПРОДОЛЖИТЕЛЬНОСТИ УБОРКИ УРОЖАЯ ЗЕРНОВЫХ КУЛЬТУР**

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**Ключевые слова:** технологический процесс, урожайность, зерновые культуры, агротехнические сроки, продолжительность уборки, потери зерна, уборочная техника, техническое состояние.

### **Резюме**

Представлен анализ научных исследований зависимости урожайности зерновых колосовых культур от сроков выполнения уборочных работ. Предлагаются разные методы определения оптимальной продолжительности уборочных работ.

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### **Resume**

The analysis of research depending on the yield of grain crops from the timing of harvesting robot. There are different methods for determining the optimal duration of harvesting.