Justification of the application type universal grain cleaning complex

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Abstract. This article summarizes the results of research of the work of Russian universal mobile grain cleaning complex. The problem of grain processing and seed preparation can be solved by using a mobile grain cleaning complex, which allows to carry out all types of cleaning (preliminary, primary and secondary). Operational and technological assessment of universal mobile grain cleaning complexes was carried out in the farms of Voronezh region of Russia. The results of the tests showed that the mobile grain cleaning complexes of universal type MGC-30U, MGC-60U and MGC-100U on all operational and technological indicators, quality indicators of technological process and reliability indicators meet the requirements of Russian standards and will find application in small and medium-sized businesses specializing in the cultivation of cereals crops.

1Introduction

Russia is one of the biggest grain-producing countries in the world, and the production of grain already is more than 100 million tons in some harvest years. But at the same time There were losses at the post-harvest processing stage and storage. These losses are from 10 to 15% of the whole yield, and crop shortage due to sowing substandard seeds are 10 ... 15 million tons [1,3,4]. To ensure uninterrupted acceptance, to decrease losses of harvested grain and improve its quality during storage - one of the most important tasks, as the employees of the food industry and agro-industrial complex [3,4].

The aim of the research is justification of necessary to use grain cleaning equipment of Russian production in cleaning of grain crops for food and seed purposes.

2 Materials and methods

The research (Table 1) was carried out by the Central Chernozem State Zonal Machine Testing Station in the farms of Russian Voronezh region [2]. For research we studied

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mobile grain cleaning complexes universal of the type MGC-_U (mobile grain cleaning complex – universal with specified capacity), MGC-30U, MGC-60U and MGC-100U.

Table 1. Conditions of research

Conditions	Values of conditions			
	Governing standard	Tests data		
		MGC-30U	MGC-60U	MGC-100U
1	2	3	4	5
Crop, variety	Cereals, leguminous crops, technical and oilseeds, corn, seeds for grass	Winter wheat «Ermak»	Winter wheat «Nemchinovka 24»	Winter wheat «Zary»
preliminary				
Grain moisture, %	To 20	13,6	13,7	13,5
Grain nature, g/l	No more 740	743	744	742
Composition of source material, %: - major grain content	none	93,95	93,48	93,69
Admixtures, total, %, incl: - grain - weed incl. straw, length, mm: up to 50 over 50	none none To 5 To 0,5 none	6,05 4,02 2,03 0,28 0	6,52 4,55 1,97 0,24 0	6,31 4,44 1,87 0,27 0
Primary				
Grain moisture, %	to 18	13,4	13,5	13,3
Grain nature, g/l	No more 750	757	753	758
Composition of source material, %: - major grain content	none	95,28	95,06	95,39
Admixtures, total, %, incl: - grain - weed	 to 5 to 3	4,72 3,45 1,27	4,94 3,77 1,17	4,61 3,51 1,10
Secondary				
Grain moisture, %	to 16	13,3	13,4	13,2
Grain nature, g/l	none	768	765	767
Composition of source material, %: - major grain content - waste grain content	 none to 3	 96,75 3,25	 96,54 3,46	 96,66 3,34
Seeds of weed, pcs./kg	to 100	60	53	49
Seed content of other plants, pcs./kg	to 200	0	0	0

3 Results and discussion

It should be noted that the design of these grain complexes is simple in technical and technological maintenance [2].

Technological process of grain complexes was carried out steadily, the coefficient of reliability of technological process on all modes of purification is 1. The results are given in

Tables 2-4, where Reproduction seeds are RS, Elite seeds are ES, Reproduction elite seeds are RES.

Table 2. Research results of the grain cleaning complex MGC-30U

Indicator	Values of indicator					
	Technical conditions			Research information		
1	2	3	4	5	6	7
Type of cleaning	preliminar	primary	secondary	preliminary	primary	secondary
Capacity of cleaning wheat, t/h: - main time	>30	>20	>10	30,80	20,30	10,30
- changeable time	none			27,00	17,68	8,99
- operating time	same			26,60	17,44	8,87
Specific electric power consumption for wheat, kWh/t.	<0,45	<0,65	<1,25	0,43	0,61	1,18
Techmological-operating coefficients						
-using changeable time	>0,75			0,88	0,87	0,87
- using operating time	>0,73			0,86	0,86	0,86
Indicators of the quality of the technological process:purity, %	none			95,57	97,00	98,32
Grain content, %	-	<3	-	3,22	2,40	1,56
Weed impurities content, %	<3	<1	-	1,21	0,60	0,12
Include straw	<0,2	-	-	0	-	-
removal of main crop grain into unused waste, %	<0,5	-	-	0,35	-	-
removal of grain (seeds) of the main crop to used waste, %	-	<2	<5	-	1,51	4,54
complete selection of grain (seeds), %	>99,5			99,84	99,83	99,85
grain (seed) crushing, %	<0,1			0,10	0,08	0,08
wheat grain norm in accordance with GOST R 52554-2006		> «average purity»	-	-	«average purity»	-
Weed seeds content, pcs./kg	-	-	<:5 – ES 20 –RS	-	-	13
Content of other crops seeds, pcs./kg	-	-	<:10 - ES 40 - RS	-	-	0
seed category in accordance with GOST R 52325-2005	-	-	ES or RS	-	-	RS

Table 3. Research results of the grain cleaning complex MGC-60U

Indicator	Values of indicator					
	Technical conditions			Research information		
1	2	3	4	5	6	7
Type of cleaning	preliminary	primary	secondary	preliminar	primary	secondary
Capacity of cleaning wheat, t/h: - main time	>60	>40	>20	60,60	40,40	20,40
- changeable time	none			53,30	35,20	17,70
- operating time	Same			52,10	34,70	17,50
Specific electric power consumption for wheat, kWh/t.	<0,25	<0,40	<0,85	0,25	0,36	0,68
Techmological-operating coefficients						
-using changeable time	>0,75			0,88	0,87	0,87
- using operating time	>0,73			0,86	0,86	0,86
Indicators of the quality of the technological process:purity, %	none			95,12	96,73	98,22
Grain content, %	-	<3	-	3,80	2,71	1,63
Weed impurities content, % Include straw	<3 <0,2	<1 -	- -	1,08 0	0,56 -	0,15 -
removal of main crop grain into unused waste, %	<0,5	-	-	0,34	-	-
removal of grain (seeds) of the main crop to used waste, %	-	<2	<5	-	1,44	4,58
complete selection of grain (seeds), %	>99,5			99,80	99,83	99,85
grain (seed) crushing, %	<0,1			0,10	0,09	0,09
wheat grain norm in accordance with GOST R 52554-2006		> «average purity»	-	-	«average purit»	-
Weed seeds content, pcs./kg	-	-	<: 5- ES 20 - RS	-	-	15
Content of other crops seeds, pcs./kg	-	-	< 10- ES 40 - RS	-	-	0
seed category in accordance with GOST R 52325-2005	-	-	ES or RS	-	-	RS

Table 4. Research results of the grain cleaning complex MGC-100U

Indicator	Values of indicator					
	Technical conditions			Technical conditions		
1	2	3	4	5	6	7
Type of cleaning	preliminary	primary	secondary	preliminary	primary	secondar
Capacity of cleaning wheat, t/h: - main time	>100	>60	>30	100,90	60,40	30,30
- changeable time	нет данных			88,79	52,55	26,66
- operating time	то же			88,59	52,42	26,36
Specific electric power consumption for wheat, kWh/t.	<0,20	<0,30	<0,65	0,19	0,30	0,57
Techmological-operating coefficients						
-using changeable time	>0,75			0,88	0,88	0,88
- using operating time	>0,73			0,87	0,87	0,87
Indicators of the quality of the technological process:purity, %	No data			95,17	96,88	98,09
Grain content, %	-	<3	-	3,73	2,51	1,65
Weed impurities content, % Include straw	<3 <0,2	<1 -	- -	1,10 0	0,61 -	0,26 -
removal of main crop grain into unused waste, %	<0,5	-	-	0,29	-	-
removal of grain (seeds) of the main crop to used waste, %	-	<2	<5	-	1,26	4,41
complete selection of grain (seeds), %	>99,5			99,78	99,80	99,83
grain (seed) crushing, %	<0,1			0,09	0,08	0,08
wheat grain norm in accordance with GOST R 52554-2006		> «average purity»	-	-	«averag purity»	-
Weed seeds content, pcs./kg	-	-	<5-ES 20 - RS	-	-	18
Content of other crops seeds, pcs./kg	-	-	<: 10 - ES 40 - RES	-	-	0
seed category in accordance with GOST R 52325-2005	-	-	ES or RS	-	-	RS

Performance indicators meet all required Technical conditions of standard (TCS). Thus, in the winter wheat heap after preliminary purification, the content of weed impurities was significantly reduced, and the content of straw impurities was equal to zero (TCS - no more than 0.2%). The content of grain admixture was also significantly reduced, i.e. the material was prepared for the efficiency of subsequent cleaning, namely, for primary cleaning. The removal of the main crop grain into the unused waste was obtained at the level of the permissible value of TU - no more than 0.5%.

Grain removal of the main grain into the waste in the primary treatment mode into the used waste were 1.51%; 1.44% and 1.26%, which met the TCS value of no more than 2%. After primary purification of winter wheat heap was brought to the basic norm of "average purity" on the content of grain admixture, and the content of weed admixture, it corresponded to the norm of "pure" standard GOST R 52554-2006.

Received after primary purification purified winter wheat material by its content of weed and grain impurities met the requirements of TCS (respectively: 3.0 and 1.0%). Purified material of the given crop on all tested grain complexes after secondary purification on quality, namely, both on purity, and on the maintenance of seeds of weeds in quantity 13 pieces / kg corresponded also to category RS. As a result, seeds obtained after secondary treatment, corresponded to the category of RES according to standard GOST R 52325-2005 (in terms of TCS - ES category or RES). Removal of seeds of the main crop into the waste used in the secondary treatment mode for grain complexes was 4.54, 4.58 and 4.41%, which met the normative value for TCS - no more than 5%.

Crushing of grain (seeds) on all modes of purification was obtained within the limits of permissible TCS value (not more than 0.1%). Completeness of selection of grain on all modes of purification and on all grain complexes was in a range from 99,78 to 99,85 % that also satisfied an admissible value on TCS - not less than 99,5 %. The sub-sorption of grain (seeds) and wastes was absent at all types of purification.

5 Conclusions

Mobile grain cleaning complexes universal MGC-30U, MGC-60U, MGC-100U by all operational and technological indicators of the quality of the process and reliability meets the requirements of standard and will find application in small and medium businesses specializing in the cultivation of grain crops.

Reference

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