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SUBSTANTIATION THE COMPOSITION OF MACHINES AND REPAIR-SERVICE BASE FOR VEGETABLE PRODUCING CLUSTERS

Khudaykuliev Rajabboy Rozmatovich
Director of the Agricultural Mechanization Research Institute

Mirzaabdullayev Khojiakbar Muhammadali ugli
doctoral student, Scientific Research Institute of Agriculture Mechanization
E-mail: hojiakbarmirzabdullayev@.gmail.com.

Kupaysinova Khurshidakhon Arabboy kizi
doctoral student, Scientific directions of the
Institute of Mechanics and Seismic Stability
of Structures named after M.T.Urazbaev
of the Academy of Sciences of the Republic of Uzbekistan

Abstract: Research results on establishment of models of agricultural production entities (for example, farms and dehkan farmers, cooperatives, holdings) and composition and quantities of equipment required for them, as well as the organization of technical service facilities for machines are specified in the article.

Key words: agroclusters, landowners, farmers and dehkan farmers, vegetables producing, rational land areas, machine-tractor fleet, grouping, major and regional models, breakdowns, service, technical service, technical service point, quantity, repair.

Introduction. In global practice, agroclusters, landowners, farmers and dehkan farmers are main entities that grow vegetables. Some specialized farms have their own fleet of machines and tractors, simple repair and maintenance areas and mobile workshops. Rest of consumers order servicing companies to eliminate the malfunctions that have occurred in their machines.

In many countries over the world, Scientific and Practical, Innovative researches on solving the problems for ensuring long-term effective use of vegetable-growing machines are being carried out. In this direction, it is one of urgent issues to carry out targeted scientific research on basis of structural and quantitative indicators of the Machine-tractor Fleet (furthermore MTF) and technical service base, which are necessary for owners of machines. In Uzbekistan, there is a necessity to establish rational fleet of vegetable-growing machinery and service stations in Vegetable- producing Clusters specializing in cultivation of vegetable products.

Materials and research methods. Methods on determining the compositon and quantity of MTF, that is necessary for entities producing vegetable products - any entity (farm, cooperative, holding and cluster) that grows agricultural products, including vegetables, should have a rational level of MTF in terms of content and quantity. Only after, agrotechnical activities will be carried out on-timely, and planned harvesting of crops will be obtained.

Graphic, economic-mathematical and regulatory methods for determining the composition and quantity of MTF are widely described in monographs and textbooks in respect of science "Using Machine-tractor Fleet" [1, 2, 3, 4, 5, 6, 7, 8, 9, 10].

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As regional model, let's use improved method to substantiate the rational values of cultivated areas of the vegetable producing clusters [11].

First, let's put values of land areas attached to them in the section of regions and districts in ascending order.

1) Republic of Karakalpakstan. In effort to carry out calculations let's use statistical description of so called grouping step. Grouping step is difference between adjacent clusters of vegetable plots.

Let's include 11 out of 12 existing clusters when grouping. We will find current values of difference between the clusters areas: 235-225(10 ha) → 307-235(72)→ 377-307(70)→ 395-377(18)→ 453-395(58)→ 533-453(80) → 667-533(134)→ 778-667(111)→ 1000-778(222)→ 1722-1000(722 ha).

Let's consider clusters 1÷7 as the 1st group. Grouping step ΔM_{G1}= 100 ha. Between current and theoretical steps, the following inequality is affordable: (10; 72; 70; 18; 58; 80) <ΔM_G= 100 ha. Let's include clusters 8÷10 into 2nd group and take the grouping step as ΔM_{G2}= 300 ha: (134; 111; 222) <ΔM_{G2} = 300 ha.

We consider 7th cluster suitable for the 1st group, and 10th cluster suitable for the 2nd group. Their rational land areas: P_{G1} = 533 ha, P_{G2} = 1000 ha.

Due to that difference between the land areas of clusters 11 and 10 is 722 hectares, let's consider 11th cluster as the largest vegetable producing cluster in the territory of Karakalpakstan: P_{11} = 1722 ha.

2) Andijan region. We involve all those 14 clusters into grouping. 162-150(12 ha) → 210-162(48)→ 250-210(40) → 263-250(13) → 280-263(17) → 296-280(16) → 355-296(59) → 378-355(23) → 382-378(4) → 576-382(194) → 952-576(376) → 2276-952(1324) → 4711-2276(2435 ha).

The following inequalities are outcoming from above shown substractions: (12; 48; 40; 13; 17; 16; 59; 23; 4; 194; 376) >ΔM_G= 500 ha; (1324; 2435) > ΔM_{G1} = 500 ha. Therefore, it is possible to include clusters 1÷12 into the 1st group and consider

vegetable area P_{G1}= 952 ha as model cluster. P_{14} = 4711 ha for the largest cluster in Region.

3) Bukhara region. Let's involve all those 5 existing clusters into grouping. 354-353(1 ha) → 397-354(43) → 693-397(296) → 941-693(248 ha). These substractions satisfy the following inequality: (1.0; 43; 296; 248) < ΔM_G = 250 ha. P_{G1}= 941 is suitable for the model clusters. There is no any with status of the largest cluster.

4) Jizzakh region. Let's involve all clusters into grouping: 221-172(49 ha) → 300-221(79)→ 534-300(234) → 610-534(76) → 886-610(276) → 1031-886(145) → 1201- 1031(170)→ 1280-1201(79) → 1557-1280(277) → 3176-1557(1619 ha) → 4000-3176(824 ha).

1÷10 are suitable for clusters: (49; 79; 234; 76; 276; 145; 170; 79; 277) < ΔM_G = 300 ha; Crops area of model cluster P_{G1} = 1557 ha. 12th cluster is the largest cluster in Region: P_{12}= 4000 ha.

5) Kashkadarya region. Let's involve 5 out of the all 8 existing clusters into groups: 556-474(82 ha) → 605-556(49) → 666-605(61) → 1071-666(405 ha). The values of differences show that 5 clusters can be included into a single group because (82; 49; 61; 405) < ΔM_Γ = 500 ha. Let's consider 8th cluster as model: $P_{\Gamma 1}$ = 1071 ha. There is no any cluster that meets the largest cluster criterion.

6) Navoi region. All those 7 clusters can be included into a single group: 303-252(51 ha) → 443-303(140)→ 503-443(60) → 567-503 (64) → 570-567(3) → 674-570(104 to). Grouping step: (51; 140; 60; 64; 3; 104) <ΔM_Γ= 500 ha. $P_{\Gamma 1}$ = 674 ha for model cluster.

There is no any largest cluster.

7) Namangan region. Let's involve into grouping all 11 out of 16 existing clusters: 570-500(70 ha) → 675-570(5.0) → 790-675(15) → 850-790(60) → 913-850(63) → 914-913(1.0) → 958-914(44) → 1078-958(120) → 1885-1078(807) → 7000-1885(5115 ha). Based on substracted figures, it is res\asonable to accept such solutions:

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1) Substractions satisfy the following inequalities: (70; 5; 15; 60; 63; 1.0; 44; 120) $<\Delta M_G=$ 200 ha;

2) 11th cluster can be considered as model cluster: P_{G1} = 1078 ha;

11th cluster with cultivated area of P_{11} = 7000 meets the status of the largest cluster in Namangan Region.

8) Samarkand region. If we compare land areas of the existing 13 clusters in the Region with aech other, we will see 9 out of them are appropriate into grouping: 1150-1137(13 ha) → 1523-1150(373)→ 1847-1523(324) → 1875-1847(28) → 1953-1875(78)→ 2440-1953(487) → 3496-2440(1056) → 4037-3496 (541 ha).

Substractions' values satisfy the following terms: (13; 373; 324; 28; 78; 487) $<\Delta M_G$ = 500 ha; (1056; 541) $>\Delta M_G$ = 500 ha.

7th cluster is the model cluster with land area of PG1 = 2440 ha. The largest cluster over the Region: P9 = 4037 ha.

9) Surkhandarya region. Let's involve all those 13 clusters into grouping: 168-148(20 ha) → 211-168(43)→ 255-211(44) → 271-255(16)→ 290-271(19) → 317-290(27)→ 335-317(18) → 452-335(117)→ 583-452(131) → 682-583(99)→ 1119-682(437) → 1216-1119(97 ha).

The subtraction values indicate the following:

1) (20; 43; 44; 16; 19; 27; 18; 117; 131; 99) $<\Delta M_G=$ 200 ha;

2) We consider 11th cluster as the model cluster: P_{G1} = 682 ha;

3) Land area of the largest cluster: P_{13}= 1216 ha.

10) Syrdarya region. Let's group 5 out of 6 existing clusters: 363-293(70 ha) → 443-363(80)→ 476-443(33) → 1097-476(621 ha).

By using those subtractions we will write the following inequalities: (70; 80; 33) < ΔM_G = 100 ha; 621 > ΔM_G = 100 ha.

It appears that 4th cluster formed model cluster with a field PG1 = 476 ha, cluster 5 with P5= 1097 ha formed the largest cluster.

11) Tashkent region. Let's summarize all of those 18 existing clusters into groups: 131-100(31 ha) → 151-131(20)→ 171-151(20) → 231-171(60) → 270-231(39)→ 286-270(16)→ 288-286(2) → 517-288(229)→ 531-517(14) → 564-531(33) → 601-564(37)→ 683-601(82)→ 833-683(150) → 864-833(31)→ 1735-864(871) → 2467-1735(732) → 2878-2467(411 ha).

After analyzing the subtraction values, we will write the following: (31; 20; 20; 60; 39; 16; 2; 229; 14; 33; 37; 82; 150; 31) < ΔM_{G1}= 250 ha; (871; 732) < ΔM_{G2} = 1000 ha.

Thus, 15th and 17th clusters are model clusters representing the first and second groups, and their land areas consist PG1 = 864 ha and MG2= 2467 ha.

18th cluster is on status of the largest cluster: P18 = 2878 ha.

12) Fergana region. Let's involve all 19 clusters into groups: 272-211(61 ha) → 282-272(10)→ 330-282(48) → 410-330(80) → 421-410(11)→ 437-421(16)→ 446-437(9) → 513-446(67) → 520-513(7)→ 523-520(3) → 550-523(27) → 572-550(22)→ 578-572(6) → 603-578(25) → 729-603(126)→ 1010-729(281)→ 1203-1010(193) → 1870-1203(667 ha).

Considering above subtractions we will write the following: (61; 10; 48; 80; 11; 16; 9; 67; 7; 3; 27; 22; 6; 25; 126) < ΔM_{G1}= 150 ha; (281; 193) < ΔMG2= 300 ha. 667 > ΔM_{G2}= 300 ha.

Inequalities show that starting from the 1st till 16th clusters form the first group; for model cluster of this group, P_{G1} = 729 ha. The model cluster specific whose area is P_{G2} = 1203 ha suites to 17th and 18th clusters. 19th cluster is taken into account as the largest cluster: P_{19} = 1870 ha.

12) Khorezm Region. Let's involve 5 out of 6 clusters into the grouping: 196-180(16 ha) → 200-196(4)→ 428-200(228) → 487-428(59 ha).

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1st – 3rd clusters are suitable for cluster model with the crops land area P_{G1} = 200 ha. 5th cluster can be considered as cluster with the largest land area: P_5 = 487 ha in Region.

Rational values of the areas for vegetable crops within the framework of production the regional model vegetable clusters in regional section serve as primary source for development the general model of clusters for the Republic, full mechanization of all technological processes in vegetable cultivation in these areas, and substantiation the compositions and quantities of technical means that ensure their completion in reasonable terms.

Research results. Let's carry out activities for development the regional master model of groups of the vegetable clusters land areas [11].

In order to develop the regional master model of vegetable cluster, based on the information mentioned above, we summarize the groups of clusters with the largest land area by groups into a single place:

P_{G2}= 1000 ha; P_{G1}= 952 ha; P_{G1}= 941 ha; P_{G1}= 1557 ha; P_{G1}= 1071 ha; P_{G1}= 674 ha; P_{G1}= 1078 ha; P_{G1}= 2440 ha; P_{G1}= 682 ha; P_{G1}= 476 ha; P_{G1}= 2467 ha; P_{G2}= 1203 ha; P_{G1}= 200 ha.

	1 000	9 52	9 41	1 557	1 071	6 71	1 078	(1)
	2 440	6 82	4 76	2 467	1 203	2 00		

(1) Total amount in the set of numbers –number of options N=13. Therefore, this set is variational series of N=13 numbers - variants. Due to that N=13<30, we calculate the mathematical expectation value of M_i, dispersion, standard deviation, coefficient of variation, lower limits of mathematical expectation value M_L and M_U using the following formulas [12]:

Mathematical expected value –

$$\overline{M} = \frac{\sum_{i=1}^{N} M_i}{N} \quad \text{either} \quad \overline{M} = \frac{\sum_{i=1}^{13} M_i}{13}; \tag{2}$$

Corrected dispersion –

$$D = \frac{1}{N-1} \sum_{N=1}^{N} (M_i - \overline{M})^2 \quad \text{either} \quad D = \frac{1}{12} \sum_{N=1}^{13} (M_i - \overline{M})^2; \tag{3}$$

Medium square deviation – $\sigma_M = \sqrt{D}$; (4)

Variation coefficient – $V_M = \frac{\sigma_M}{\overline{M}} 100\%$. (5)

Macthematical expected value $\overline{M}$ lower M_L and upper M_U marginal values:

$$M_{\Pi} = \overline{M} - t_a \frac{\sigma_M}{\sqrt{N}}; M_{ю} = \overline{M} + t_a \frac{\sigma_M}{\sqrt{N}}. \tag{6}$$

At (6) t_a - It is coefficient of the Student's distribution and is determined for Navoi Region based on degree of freedom = −1 and the accepted reliability probability level ( ) [13]. Since =13, =13−1=12. Let's assume that =0.95. Since N=13, r=13-1=12 = $t_a = t_{0,95}$ = coefficient corresponds to parameters r=12 and a=0.95 for Navoi region. If we put the values N=13 and $t_{0,95}$ = 2.20 in (6),

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$$M_{П} = \overline{M} - 2{,}20\frac{\sigma_M}{\sqrt{13}}; M_{ю} = \overline{M} + 2{,}20\frac{\sigma_M}{\sqrt{13}} \text{ either}$$

$$M_{П} = \overline{M} - 0{,}610\sigma_M; \quad (7)$$

$$M_{ю} = \overline{M} + 0{,}610\sigma_M; \quad (8)$$

(1) We determine the mathematical expectation value by putting numbers from the set of amouts (1) into the sum (2):

$$\overline{M}\frac{1}{13}(100 + 952 + 941 + 1557 + 1071 + 674 + 1078 + 2440 + 682 +$$

$$+ 476 + 2467 + 1203 + 200) = \frac{1}{13}\ 14741 = 1134\ ha$$

Let's determine corrected dispersion value by using (3):

$$D\frac{1}{12}[(1000 - 1134)^2 + (952 - 1134)^2 + (941 - 1134)^2 + (1557 - 1134)^2 +$$

$$+ (1071 - 1134)^2 + (674 + 1134)^2 + (476 - 1134)^2 + (2467 - 1134)^2 +$$

$$+ (1203 - 1134)^2 + (200 - 1134)^2 + \frac{1}{12}[(-134)^2 + (-182)^2 + (-193)^2 +$$

$$+ (423)^2 + (-63)^2 + (-460)^2 + (-56)^2 + (1306)^2 + (-452)^2 +$$

$$+ (-658)^2 + (1333)^2 + (69)^2 + (-934)^2] = \frac{1}{12}(17956 + 33124 + 37249 +$$

$$+ 178929 + 3969 + 211600 + 3136 + 1705636 + 204304 + 432964 +$$

$$+ 1776889 + 4761 + 872356 = \frac{1}{12}\ 5482873 = 456906\ (ha)^2.$$

Let's determine amount of medium square deviation my using (4) formula:

$$\sigma_M = \sqrt{456906} = 676\ ha.$$

Let's determine variation of V_M coefficient by means of (5):

$$V_M = \frac{676}{1134}\ 100\% = 59\%.$$

Let's calculate lower M_L and upper M_U margins of the mathematic forecast in accordance with (7) and (8) formulas:

$$M_L = 1134 - 0{,}610\ \ 676 = 1134 - 412 = 722\ ha;$$

$$M_U = 1134 + 0{,}610\ \ 676 = 1134 + 412 = 1546\ ha.$$

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Discussion of results. It is obviously from results of the research that it is proposed to make rational crop area E_M of regional master model of vegetable producing clusters by groups equal to higher margin of mathematical expected value with 95 percent accuracy, that is, $E_M=M_U=1546$ ha.

Summary. Outcomes from implemented researches, regional models of vegetable producing clusters in the Republic of Karakalpakstan and regions and moreover clusters with the largest cultivated areas were selected. Based on rational values of selected model and the largest clusters of vegetable producing areas, types, models and number of equipment (machines) that can fully and qualitatively perform the processes specified in technological maps for vegetable producing were calculated.

Based on carried out calculations, we will consider model land area of the largest vegetable producing cluster in the Republic as $E_E=4622$ ha.

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