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The concept of production resources in agricultural sector and their classification in the case of Uzbekistan

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ABSTRACT

The paper focuses on the institutional shifts in agricultural relations that establish the prerequisites for raising production efficiency in the context of agriculture's transition. It was investigated how quickly and qualitatively new structural and market reforms could be introduced in the agricultural sector. Sustainability and organizational development of state assistance that is effective in the face of market volatility and development transformation processes is predicated on the enhancement of the mechanism. Agriculture-related subsidies, the application of resource-saving technology, and specifically the efficacy of water-saving technologies were examined.

Keywords: Sustainable transformation, Agriculture, Modernization, Subsidies, Institutional change, Cluster, Cooperation, Drip Irrigation.
Article type: Research Article.

INTRODUCTION

A significant portion of Uzbekistan's economy—17% of the country's GDP—remains devoted to agriculture. It is crucial to boost rural residents' incomes and employment opportunities through agricultural production in order to meet the nation's food demands. A number of factors, including erratic rainfall patterns, chilly winters and scorching summers, might undermine the continuous rise in agricultural productivity (Andryakov *et al.* 2019). Unwise use of land and water is another factor contributing to the decline in crop output in agriculture. Deterioration of land reclamation and inefficient use of water are caused by relatively low effective usage of irrigation networks and non-operation of large-scale irrigation systems (Burkhanov *et al.* 2022, 2023). The introduction of the cluster system, which is a completely modern form of management based on market mechanisms, in agriculture fully justifies itself in practice. This innovative system is becoming an important tool for the development of the agricultural sector, a guaranteed source of income for the rural population. At present, 651 agroclusters are operating in all directions in our country, and 100% of cotton and grain, and more than 40% of fruits and vegetables belong to such enterprises. Agroclusters effectively carry out the main tasks of

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modernization of agriculture, industrialization of the sector, deep processing of products, export of ready-made products with added value, not raw materials, and reduction of poverty (Iminova & Sindarov 2019; Haro Altamirano *et al.* 2024; Hasanov *et al.* 2024). As a result, the rate of fiber processing increased by 2.5 times in cotton farming alone. Due to the fact that 100% of the harvest is processed in our country, the production of yarn has doubled, and the volume of finished products has increased by three times. The annual export amount in this regard was about 3 billion dollars. It is extremely important that our cluster leaders, farmers and peasants, who know the value of the land, make good use of every inch of it, and create a unique experimental school, are also achieving high results in the fields of fruit and vegetable, rice, medicinal herbs, animal husbandry and other fields (Xidirberdiyevich *et al.* 2020; Xu *et al.* 2023; Yu *et al.* 2023). As you know, in recent years, serious attention has been paid to improving the productivity of agricultural land, reusing unused cropland, and developing dry land. In 2020-2021, 369,000 hectares of land were brought back into use. In order to support the introduction of water-saving technologies, a state subsidy allocation system was established. Also, the work on establishing new greenhouses and ensuring the stability of the price of food products is giving its positive results. In particular, in 2021 alone, 398 modern greenhouses worth 2.3 trillion soums were put into operation on 797 hectares of land, providing employment to more than 11,000 people. All this, in addition to meeting the needs of the domestic market, expands export opportunities, develops beautiful and convenient trade, logistics centers and processing enterprises in rural areas.

Exports

At this point, notably, the export indicators of leguminous products increased by 122%, grape products by 142%, vegetables by 103%, and nut products by 1.8 times. At the moment, we should focus on working on new projects, increasing the volume of production, increasing the types of services and further improving their quality, as well as training qualified specialists with the wide implementation of the principles of market mechanisms. Based on these requirements and criteria, it is planned to introduce large-scale reforms in the field (Mustapha *et al.* 2023; Petrenko *et al.* 2023; Sadiq *et al.* 2024).

Fixed assets are very diverse and include a large number of labor tools. Depending on the purpose of agricultural production funds, the following description was adopted.

1. The main production funds for agriculture: buildings, structures, transmission devices, machines and equipment, measuring and adjusting instruments and equipment, laboratory equipment and other main funds.
2. Non-agricultural primary production funds: industrial production funds, construction funds, trade and catering funds.
3. Basic funds not intended for production: funds of housing, communal economy and household services, educational organizations, cultural and art organizations, health care, physical education and social welfare organizations.

The growth and improvement of basic funds is a decisive condition for strengthening the material and technical base of agriculture and raising the material and cultural standard of living of rural workers. The size and composition of funds are determined by many conditions. The main ones are the level of development of agriculture and animal husbandry sectors, further improvement of specialization of agricultural production.

A.T. Egamov proposed the following expression to determine the resistance to traction of the trowel:

$$P = W_{\Pi} g \rho_{\Pi} ff' + H_0 B \times \left[\left(\frac{\rho_{\Pi} g R \sin\alpha}{2(1-\Delta\alpha)} + \rho_{\Pi} \mu V_n^2 \sin\alpha \right) \times \right.$$
$$\left. \times \left(\sin\alpha - \cos\alpha \, tg\varphi \right) \right],$$

where W_n is the soil prism formed in front of the grinder-leveler volume (m^3); f , f' are coefficients of external and internal friction of the soil; N_0 - the depth of the ground leveler (m); B – coverage width of the trowel-leveler (m); R is the radius of curvature of the working body (m); m is a coefficient that takes into account the change in the speed of movement of soil fragments depending on the depth of the layer; r_P - soil density (kg m^{-3}); Da is the density coefficient of the soil; V_n - unit movement speed (m s^{-1}); φ is the angle of external friction of soil ng (°).

In the expression, the factors affecting the traction resistance of the grinder-leveler are not sufficiently taken into account.

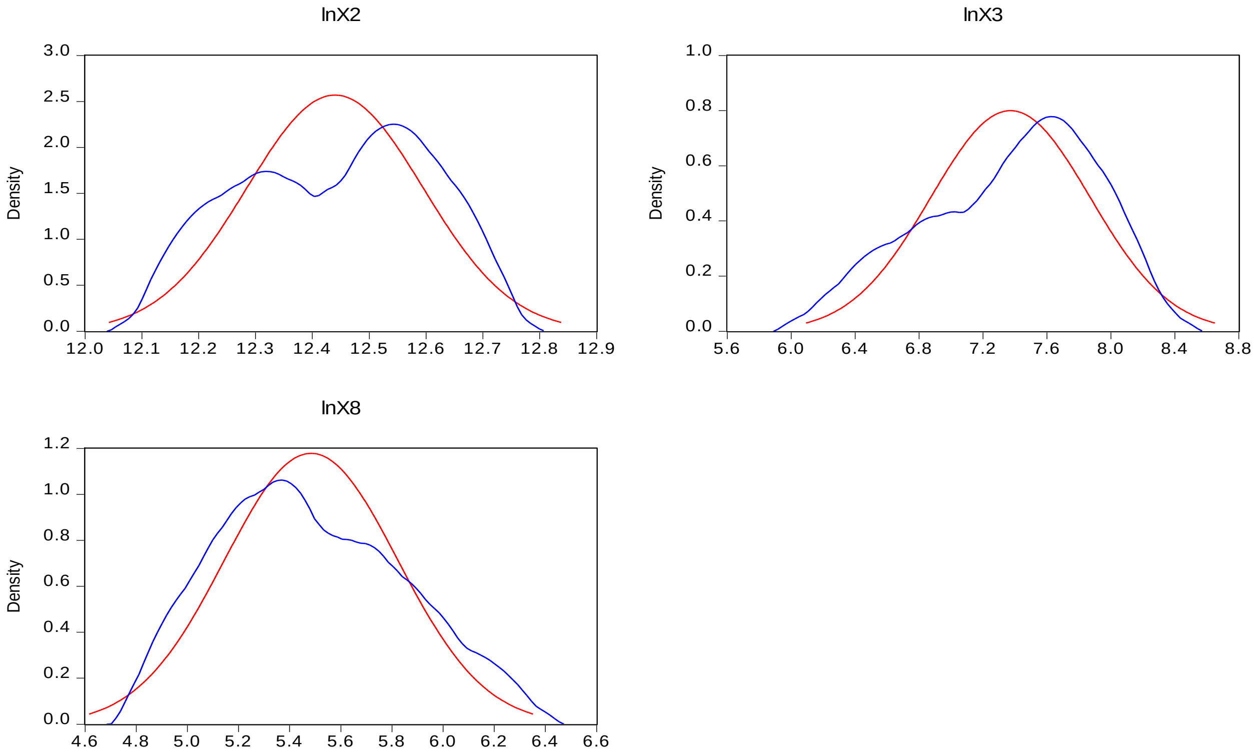

Fig. 1. Improving agricultural system and all factors.

M.P. Kalimbetov carried out scientific-research works on the basis of the parameters of the grinder-leveler, which consists of several leveling-densifying work bodies located in front and behind. In order to ensure the leveling of the field surface at the required level and the compaction of the soil with low energy consumption, the leveling-compaction has three leveling-compaction work bodies that are staggered with a 10 mm difference in the direction of movement of the leveler-compacter. In addition, the installation angles of their leveling-compaction surfaces relative to the horizon (40-45°) showed that the height of the working part should be 15-17 cm, the longitudinal distance between them 156-160 cm, and the relative vertical compressive strength in the range of 2.4-3.5 kN/m. However, this leveler was not introduced to agricultural production either. The main reason for this is the fact that it can be produced only in the trailer version (due to the length of the longitudinal base) and the resulting consequences (low maneuverability, the need for a large turning area, low productivity).

MATERIALS AND METHODS

The theoretical and methodological foundation for boosting agricultural production efficiency is built upon the research conducted by domestic and international scientists and experts, a thorough and methodical approach to the examination of the processes under study, and the most significant economic concerns pertaining to Uzbekistan's agricultural sector. Documents pertaining to legislation, normative law, state body programmes, and anticipated developments were all provided. Specialised scientific techniques, including monographic, abstract-logical, analytical, observational, analytical, comparative, and generalising were employed throughout the study.
Working capital transfers its value entirely to the product produced or work performed. Components of working capital are production and circulation funds, between which there is an integral connection and interconnection.
Circulation work release Funds:
- young goods and to his stomach being fed cattle, poultry, wild animals and bees nests;
- work release reserves, feed, seeds, seedlings, care parts, oil products, fuel, mineral fertilizers, assistant enterprises again work for raw material, addition materials are cheap and fast from work coming out items.
- in animal husbandry, industry enterprises and in workshops unfinished work issue, forthcoming years crop for done expenses.

Enterprises circulation funds with reasonable provision, production release in the process of them complete and efficient use the most less work and funds spent without removable gross the product much increase enable will give. It is necessary to constantly update and improve the basic funds of agricultural enterprises, which is a necessary condition for upgrading the sector and increasing labor productivity in the agricultural and livestock industries.

In a farm, tractors, combine harvesters and other agricultural machines, vehicles, production buildings and other such main means of production are involved in the production of products, and as a result, they gradually wear out, and finally fail after a few years of service.

Depreciation of assets two different will be:

1) natural wear out or physicist eating

2) spiritual wear out

Physics eating. properties work in release participation as a result little by little worn out is going.

Spiritual depreciation. properties work in release participation reach deadlines without ending out is to leave. This is, first of all, technique development as a result new and productivity in terms of high to indicators have machines when created, machines price cheaper, less cost will be machines work when released happen will be

main tools again repair process depreciation and depreciation allocation with depends

Depreciation this used work release tools money in the expression coverage, each different kind of things perform or another village household products discounts for to expenses known one part their initial the price is to add. Har one in the enterprise depreciation fund organize will be done.

Of the enterprise main tools yearly depreciation allocation (A_a), set yearly depreciation norm and balance value based on is determined:

$$A_a = \frac{B_k}{N_a} \cdot 100$$

where: B_k is the main one tools balance value; N_a is the main one of means depreciation standard. Depreciation norm work release in the process them to use conditions, basic tools installed to use deadlines with is expressed. Use term how less if so, that much depreciation allocation percentage more will be. Agribusiness means business in the field of agriculture, and it is one of the components of the market system. Agribusiness also exists in Uzbekistan, it is developing in the form of an agro-industrial complex. Agri-industrial complex (AIC) is a set of national economic sectors involved in the production, storage, processing and delivery of agricultural products to the consumer.

AIC generally includes 4 areas:

1-The first sector includes industries that supply agricultural production tools, as well as industries engaged in providing agricultural production and technical services;

2-The second sector is agricultural enterprises themselves;

3-The third sector is the sectors that ensure the delivery of agricultural products to the consumer (processing, preparation, storage, processing, sale);

4-The fourth sector is infrastructure, that is, economic sectors that provide conditions for production and people's activities (road transport, communication, material and technical services).

RESULTS AND DISCUSSION

The primary subjects of agribusiness are today's farmers (peasants) because they produce agricultural products. Farming is a form of small business. Farming in Uzbekistan takes place in the form of transforming the state farms inherited from the totalitarian regime into a farmers' council and establishing farms within them, as well as organizing a farmer in collective cooperative farm at the expense of a part of the resources of the working state and collective farms. Despite the large-scale privatization process in agriculture, land remains state property. Agriculture is managed by establishing state orders for the most strategically important agricultural products, cotton and wheat. On the other hand, the state supports agriculture in many ways by providing subsidies, loans, and tax breaks.

We define the kinetic production function for each cluster and use the statistics of the following factors for the last ten years.

X_1 – total land area at the disposal of agricultural producers (thousand ha); X_2 – annual average number of workers (thousands of people); X_3 – annual value of the main production funds (billion soums); X_4 – annual working capital (billion soums);

We define the production function for cluster 1. For this, we take the average of the indicators based on the general statistical data of the resources for the districts included in the 1st cluster (Table 2).

Table 1. Average values of indicators of clusters by production resources

Indicators	Clusters			
	Cluster 1	Cluster 2	Cluster 3	Cluster 4
P1	39.54	30.62	43.95	33.6
P2	107.54	134.36	250.55	286.15
P3	17.44	12.94	25.4	12.85
P4	3563.2	3702.6	5271.5	6825.5
P5	330	343	474.5	632
P6	2130.8	1308.8	2294.5	1108
P7	18	10.6	10.15	4.45
P8	4,214	2,776	1,495	2,385
P9	0.392	0.256	0.14	0.22

Table 2. Factor score for cluster 1 kinetic production function.

X_1	X_2	X_3	X_4	ln (x_1)	ln(x_2)	ln(x_3)	ln(x_4)	ln(y)
102.86	15.98	637.1912	58.29837	4.633369	2.771338	6.45707	4.065574	5.951788
103.06	16.54	818.0562	74.21	4.635311	2.805782	6.706931	4.306899	6.197869
411.46	17.14	952.371	86.93511	6.019712	2.841415	6.858955	4.465162	6.349034
104.56	18.14	1155.796	103.394	4.649761	2.898119	7.052545	4.638547	6.523797
105.12	19.34	1364.927	123.7172	4.655103	2.962175	7.218856	4.817998	6.706006
105.74	19.66	1627.514	148.2029	4.660983	2.978586	7.394809	4.998583	6.888042
106.4	20.36	2170.896	200.5476	4.667206	3.013572	7.682895	5.301052	7.181835
106.72	20.88	2683.26	242.1811	4.670209	3.038792	7.894788	5.489686	7.380829
107.04	21.4	3005.553	277.4428	4.673203	3.063391	8.008217	5.625615	7.50286
107.54	21.872	3563.296	329.934	4.677863	3.085207	8.178441	5.798893	7.664196

The presence of a high degree of correlation between these factors prevents them from being included in the model at the same time. So, we consider their effects separately. As a result, we build the following empirical models.

Table 3. Functions developed to estimate the impact of resources on production volume for cluster 1

No	model	Student criteria	Coefficient of determination
1	$lnY = 2,32 \times lnX_2$	$b_1 = 64.66$	0.99
3	$lnY = -0.51 + 1,0 \times lnX_3$	$b_0 = -15.18$	0.99
		$b_1 = 217.5$	
4	$lnY = 1.92 + 0,99 \times lnX_4$	$b_0 = 101.6$	0.99
		$b_1 = 261.2$	

The coefficients of determination of the models are very high, and each coefficient is adequate according to the Student's criterion. Here we did not pay special attention to Fisher's criterion, because it is not needed in a one-factor function.

The following can be said about the built models:

- the relationship between the change of agricultural land and the volume of gross product production was not determined. The reason for this is that the change of the product volume in the next period is provided at the expense of intensive factors;
- a 1% increase in the number of workers leads to a 2.32% elevation in the volume of gross product production;
- a 1% elevation in the amount of fixed assets leads to a 1% change in the volume of gross product production;
- a 1% upraise in the amount of working capital leads to a change in the volume of gross product production with a regularity of 0.99.

Here, the highest elasticity index belongs to the resource x_2, which justifies the fact that agriculture is the most labor intensive. On the other hand, if we take into account that agriculture is an important sector in providing employment, this situation can be accepted as natural.

From the data in the table, we can see that the model is adequate according to the given criteria, and the coefficients of determination have a high value. The analysis using these models is based on the fact that conclusions can be drawn. Taking this into account, the following conclusions can be drawn based on the results of the developed models:

- Unlike the first cluster, there is a high correlation between the land area and the volume of gross product

production. Besides, the coefficient of elasticity between both indicators is getting a high value. That is, a 1% increase in land area ensures an elevation in gross product volume by 1.27%;
- the coefficient of elasticity of the volume of gross product production in terms of the number of labor force has almost the same value as the indicator in the first cluster and remains the highest indicator;
- the coefficient of elasticity for the amount of fixed assets and working capital remains almost equal to the value in the first cluster.

We did not find it permissible to pay special attention to the production functions for cluster 3, since the obtained results are almost the same as the results obtained for cluster 2.

Table 4. Functions developed to estimate the impact of resources on production volume for cluster 2

No	model	Student criteria	Coefficient of determination
1	$lnY = 1,27 \times lnX_1$	b1 =41.03	0.99
2	$lnY = 2,24 \times lnX_2$	b1 =59.07	0.99
3	$lnY = -1.05 + 0,99 \times lnX_3$	b0=-17.41	0.99
		b1 =217.3	
4	$lnY = 1.33 + 0,99 \times lnX_4$	b0=43.44	0.99
		b1 =172.1	

Table 5. Functions developed to estimate the impact of resources on production volume for cluster 4

No	model	Student criteria	Coefficient of determination
1	$lnY = 1,08 \times lnX_1$	b_0 = 32.25	0.99
2	$lnY = 2,26 \times lnX_2$	b_1 = 50.01	0.99
3	$lnY = -1.78 + 0,99 \times lnX_3$	b_0 = -52.86	0.99
		b_1 = 234.0	
4	$lnY = 0.59 + 0,99 \times lnX_4$	b_0= 24.29	0.99
		b_1 = 223.5	

According to the results of cluster 4, the main difference is observed between the land area and the volume of gross product production, i.e., the coefficient of elasticity is slightly decreased.

Thus, the results of the analysis of production functions and elasticity coefficients for all clusters are as follows.

1) The efficiency of agricultural land use has an average indicator, and only in cluster 4 the optimal amount of land resources is 281 thousand hectares, while the efficiency is below average.

2) Efficiency of using labor resources has an average indicator, and in all cases the coefficient of elasticity is greater than 2. It can be seen that using labor remains more efficient than capital in all clusters. The main reason for this is the relatively cheap labor force.

3) The index of effective use of the main production fund resource has an average value in all clusters, and the elasticity coefficient is one, which means that a 1% increase in the amount of funds leads to a 1% elevation in the gross product.

4) The same situation can be observed in terms of the efficiency of using annual working capital, i.e., the coefficient of elasticity is 0.99. Based on the obtained results, we evaluate the indicators of effective using resources in the process of production of agricultural products of the region.

The formation of farms as a new form of management in the agrarian sector, on the one hand, allows the emergence of real property owners, and on the other hand, creates the basis for the formation of a certain level of competitive environment with agricultural enterprises based on other types of ownership.

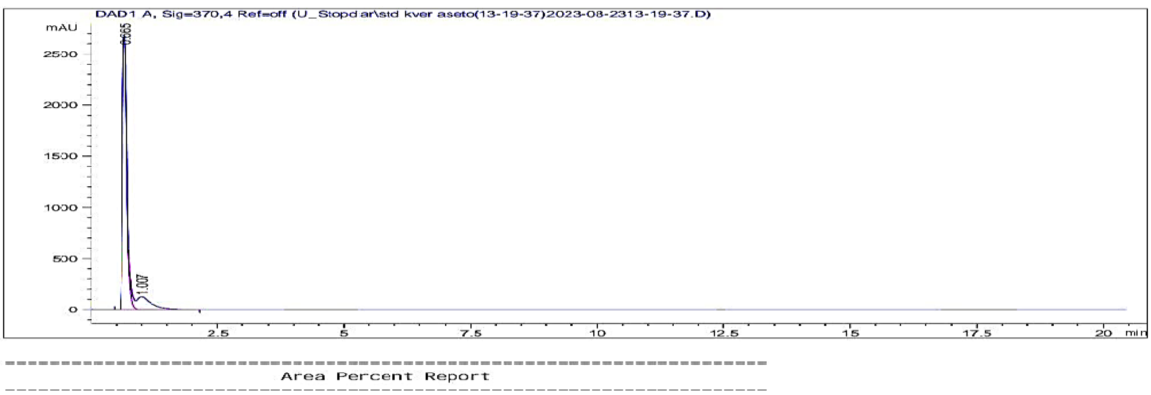

Fig. 2. Increasing of agricultural system.

In addition to leveling and compacting the surface of the soil, this trowel-leveler effectively grinds the surface part of the soil due to the fact that its side edges are connected with curved surfaces.

In order to ensure high performance with minimal energy consumption, the researches showed that the radius of curvature of the surface connecting the working surfaces is 300-350 mm, the length of the working surfaces 200, 300 and 400 mm, the specific pressure applied to the soil 2.0, 4.0, 7.0, kPa (respectively for light, medium and heavy soils) and showed that the working speed should be 1.9-2.5 m s^{-1}.

However, due to the complexity of its construction, the fact that it is trailerable like MV-6.0 and MV-6.5 levelers, high material-energy density, low maneuverability, and the need for a large turning area, this leveler was not put into production.

$$P = fmg\cos j + \frac{Bh_{np}^2 \rho g}{2} A_{np}(\cos\beta - tg\mu_0 \sin\beta) + \rho F_0 V^2,$$

where *f* is the coefficient of friction of the working body to the soil;

g – acceleration of free fall (m s^{-2}) ;

j – angle of compaction of the working body (°);

h_{pr} - the height of the prism formed in front of the working body (m);

A_{pr} – the coefficient depending on the cutting angle of the working body;

m_0 – angle of internal soil friction (°);

F_0 – surface of cross-section of unevenness (m^2);

V - speed of movement of the working body, (m s^{-1});

b - cutting angle of the working body (°).

The following expression was obtained by them to determine the vertical force that ensures the sinking of the disk to the specified depth

$$Q_\partial = q_0 \left\{ \delta \cdot R \left[\sqrt{2Rh_k - h_k^2} - (R - h_k)\arcsin\frac{\sqrt{2Rh_k - h_k^2}}{R} \right] + \right.$$
$$+ \frac{\left(R - \frac{t}{4}ctg\gamma\right)t}{\sin^2\gamma} \cdot (\sin\gamma - f\cos\gamma) \times$$
$$\left. \times \left[\sqrt{\left(R - \frac{t}{4}ctg\gamma\right)^2 - (R - h_k)^2} - (R - h_k)\arcsin\frac{\sqrt{\left(R - \frac{t}{4}ctg\gamma\right)^2 - (R - h_k)^2}}{\left(R - \frac{t}{4}ctg\gamma\right)} \right] \right\}, \quad (1.2)$$

where q_0 is the volume compression coefficient of the soil (N m^{-3}) ;

δ– thickness of disk blade (m);

R - the radius of the disc (m);

etc - the depth of sinking of the disc into the specified soil (m);

t - the thickness of the disc (m);

γ - half of the disc sharpening angle (grad);

f - the coefficient of friction of soil to metal.

A number of mistakes were made by the authors in deriving the expression. In particular, according to the expression (1.2), γ increasing the angle causes γQ_d to decrease, and in practice an elevation will lead to an upraise in this indicator. Since γ increases, the vertical force acting on the disc's pons elevates. Second, the second component of Qd the force required to sink the blade, was not taken into account when calculating the vertical load for sinking the disc-shaped part into the soil.

If we assume that under the action of the teeth, the blade breaks due to displacement, its angle of refraction is according to the formula as follow.

$$\psi = \frac{\pi}{2} - \frac{1}{2}\left(\alpha + \varphi_n + \varphi_c\right),$$

where α- the angle of entry of the tooth into the soil;

φ_p, φ_s are internal and external soil friction angles.

Using the scheme, taking into account the formula 1 and the tooth width $b = V_q$, we get

$$B_{ю} = b + \frac{2htg\theta}{\cos 0{,}5(\alpha + \varphi_n + \varphi_c)}; \qquad l_c = \frac{h}{\cos 0{,}5\left(\alpha_{б} + \varphi_1 + \varphi_2\right)},$$

where h is the processing depth of the tooth (m);

$$\theta = \frac{\pi}{4} - \frac{\varphi_n}{2} \text{ - Mohr corner (grad).} \quad (2)$$

With respect to Mohr's angle and refraction surface ψ differs, i.e., it is located at an angle. l_q of the displaced palaxa and to find the widths of the upper l_{yu}, we consider the forces acting on the blade being compressed by the action of the teeth.

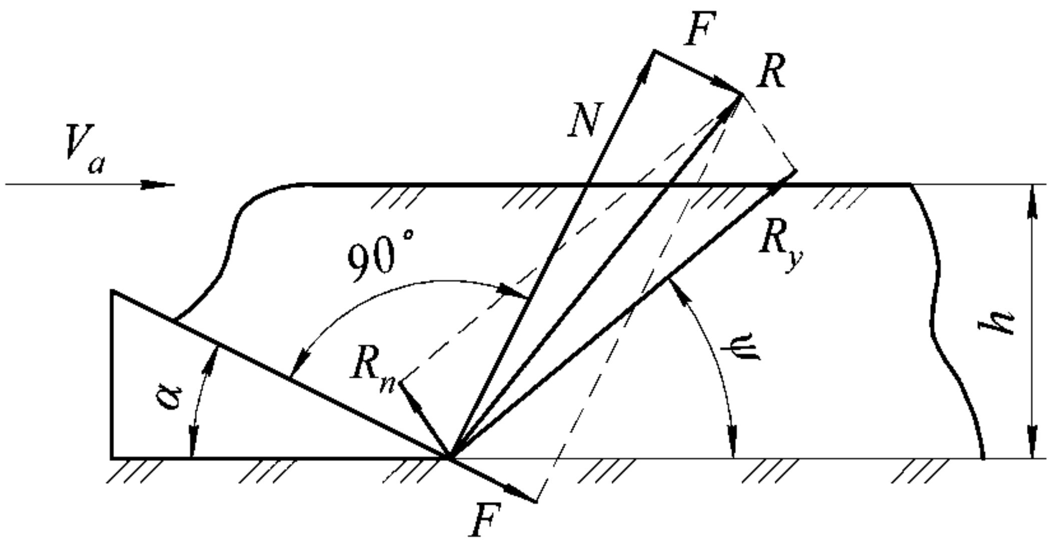

Fig. 3. Schematic diagram of the factors acting on the agricultural development.

It is affected by normal N and friction F *forces*. We divide these forces into equal-acting forces $R = N\sqrt{1 + tg^2\varphi_c}$ R_u directed along the fracture plane and R_p perpendicular to it

$$R_y = N\cos 0{,}5\left(\alpha + \varphi_n - \varphi_c\right)\sqrt{1 + tg^2\varphi_c};$$

$$R_n = N\sin 0{,}5\left(\alpha + \varphi_n - \varphi_c\right)\sqrt{1 + tg^2\varphi_c}. \quad (4)$$

R_u and R_x *forces* produce tensile τ and normal stresses on the fracture surface σ

$$\tau = \frac{N\cos 0{,}5\left(\alpha + \varphi_n - \varphi_c\right)\sin^2\psi\sqrt{1 + tg^2\varphi_c}}{\left[b\sin\psi + htg\left(\frac{\pi}{4} - \frac{\varphi_n}{2}\right)\right]h};$$

$$\sigma = \frac{N \sin 0{,}5\left(\alpha + \varphi_c - \varphi_n\right)\sin^2 \psi \sqrt{1 + tg^2 \varphi_c}}{\left[b \sin \psi + htg\left(\frac{\pi}{4} - \frac{\varphi_n}{2}\right)\right]h}.$$

n [τ in formula 5 equal to $\tau_ч$] and solve it with respect to *N*:

$$N = \frac{\left[\tau_ч\right]\left[b \sin \psi + htg\left(\frac{\pi}{4} - \frac{\varphi_n}{2}\right)\right]h}{\cos 0{,}5\left(\alpha + \varphi_c - \varphi_n\right)\sin^2 \psi \sqrt{1 + tg^2 \varphi_c}}$$

or subject to:

$$N = \frac{2\left[\tau_ч\right]\left[b \cos 0{,}5(\alpha + \varphi_n + \varphi_c) + h \cdot tg\left(\frac{\pi}{4} - \frac{\varphi_c}{2}\right)\right]h \cdot \cos^{-1} 0{,}5(\alpha + \varphi_n + \varphi_c)}{\left[\cos\left(\alpha + \varphi_c\right) + \cos \varphi_n\right]\sqrt{1 + tg^2 \varphi_c}}$$

where [τ_χ] is the ultimate shear stress of the soil.

If the compressive strength of the soil before failure is considered to be directly proportional to its volume, the force *N* can be determined by the following expression

$$N = q_0 Qb,$$

where q_0 is the volume compression coefficient of the soil;

Q is the face of the cross-section of crushed soil under the influence of teeth.

q_0 can be generally expressed as follow:

$$q_0 = mh^n (1 + K_V V_c),$$

where *m* is the proportionality coefficient;

n - depends on the physical and mechanical properties of the soil coefficient;

KV *is* the volume compression coefficient of the soil to its compression speed coefficient taking into account the dependence(s m^{-1});

V_s is the speed of crushing of the soil by the teeth (m s^{-1}).

If we consider that the soil is crushed by the tooth in the direction perpendicular to its working surface until it breaks down

$$V_c = V_a \sin 0{,}5\alpha.$$

The expression will have the following form:

$$q_0 = mh^n (1 + K_V V_a \sin 0{,}5\alpha).$$

Based on the scheme presented:

$$Q = \frac{l_к^2 \cdot \cos 0{,}5(\varphi_n + \varphi_c - \alpha)\sin \alpha}{2 \cos 0{,}5(\alpha + \varphi_n + \varphi_c)}.$$

q_0 and substituting the values of *Q* from into, we get:

$$N = \frac{0{,}5 \cdot m \cdot h^n \cdot l_к^2 (1 + K_V \cdot V_a \cdot \sin 0{,}5\alpha) \cdot b \cdot \cos 0{,}5(\varphi_n + \varphi_c - \alpha)\sin \alpha}{\cos 0{,}5(\alpha + \varphi_n + \varphi_c)}$$

The result obtained by equating the right sides of the expressions and is λ_q solving with respect to, we get the following formula:

$$l_к = \frac{2\left\{[\tau_ч]\left[b\cdot\cos 0{,}5(\alpha+\varphi_n+\varphi_c)+h\cdot tg\left(\frac{\pi}{4}-\frac{\varphi_c}{2}\right)\right](1+tg^2\varphi_c)^{-\frac{1}{2}}\right\}}{\left\{m\cdot h^{n-1}(1+K_V\cdot V_a\cdot\sin 0{,}5\alpha)\cdot b\cdot\cos 0{,}5(\varphi_n+\varphi_c-\alpha)\cdot\sin\alpha[\cos(\alpha+\varphi_c)+\cos\varphi_n]\right\}^{-\frac{1}{2}}}$$

From the circuit, we obtain the following connection using the theorem of sines

$$l_ю = l_к\frac{\cos 0{,}5(\varphi_n+\varphi_c-\alpha)}{\cos 0{,}5(\alpha+\varphi_n+\varphi_c)}.$$

l_q according to the following expression:

$$l_ю = \frac{2\left\{[\tau_ч]\cdot\left[b\cos 0{,}5(\alpha+\varphi_n+\varphi_c)+htg\left(\frac{\pi}{4}-\frac{\varphi_c}{2}\right)\right]\cdot\cos 0{,}5(\varphi_n+\varphi_c-\alpha)\cdot(1+tg^2\varphi_c)^{-\frac{1}{2}}\right\}}{\left\{\left(mh^{n-1}(1+K_V\cdot V_a\cdot\sin 0{,}5\alpha)\cdot b\cdot\cos^2 0{,}5(\alpha+\varphi_n+\varphi_c)\cdot\sin\alpha[\cos(\alpha+\varphi_c)+\cos\varphi_n]\right)\right\}^{\frac{1}{2}}}$$

Expressions take into account the physical-mechanical properties of the soil, the change of the soil volume compression coefficient depending on the depth of processing and the speed of work. The analysis of the expressions the dependence of the size of the blade separated from the action of the tooth, the resistance to traction and the level of soil compaction, the width of the tooth, the angle of installation, the depth of processing, and the physical and mechanical properties of the soil. l_{yu} is, the better the quality of soil compaction, the lower the resistance to traction. The analysis of expression shows that for the given working conditions, depth of cultivation, and speed, the value of l_{yu} is minimal and the quality of soil compaction is high, and the traction resistance of the tooth is low, which can be achieved due to the correct selection of its width and the angle of entry into the soil.

Using the schemes presented above and the obtained analytical expressions, we justify how much height should be raised by the length of the tooth for the splitting of the blade.

$$h_б = l_к\sin\alpha$$

or considering

$$h_б = \frac{2\left\{[\tau_ч]\cdot\left[b\cos 0{,}5(\alpha+\varphi_n+\varphi_c)+h\cdot tg\left(\frac{\pi}{4}-\frac{\varphi_c}{2}\right)\right]\cdot(1+tg^2\varphi_c)^{-\frac{1}{2}}\right\}}{\left\{\left(m\cdot h^{n-1}(1+K_VV_a\cdot\sin 0{,}5\alpha)\cdot b\cdot c0s0{,}5(\varphi_n+\varphi_c-\alpha)\right)\cdot\sin\alpha[\cos(\alpha+\varphi_c)+\cos\varphi_n]\right\}^{\frac{1}{2}}\cdot\sin\alpha}$$

Plant products made up 53.2% of agricultural products in 2018, while livestock products made up 46.8%. 3.7 million persons (or 27.2% of all employed people) worked in agriculture in 2017. As of January 1, 2019, 33.25 million people lived in Uzbekistan, with 16.45 million of them (49.5% of the total population) residing in rural areas. This means that nearly half of the population of the nation is rural. Agriculture is one of the most regulated economic sectors at the same time. The market for agricultural products, production resources, and services has not yet evolved, and the property rights of major agricultural producers and farmers are highly fragile (Khajimuratov *et al.* 2023; Khurramov 2023; Jabborova *et al.* 2024; Liu *et al.* 2024). Official statistics show that, with the exception of cotton, the production of the major agricultural product categories is rising annually. This is particularly true for items made from fruits and vegetables, whose processing and export are expanding in tandem with their production Usmanovich Burkhanov *et al.* 2021; Vivar-Arrieta *et al.* 2023; Wang *et al.* 2023). There has also been a notable upsurge in the output of cattle products. These indicators should be carefully studied, as the majority of animal products are produced on farms, and their statistical reports are generated in a distinctive manner (Egamberdievich *et al.* 2019; Chandramowleeswaran *et al.* 2023). Under the right conditions and with efficient state management, Uzbekistan's agriculture sector—which accounts for 32% of GDP and employs 27%

of the working population—has the potential to be a major driver of economic growth in the nation. If this policy is implemented effectively, thousands of new jobs will be created in rural regions, as well as an increase in the amount of agricultural products exported and the revenue of farmers and agricultural organisations. The populace will be able to afford a greater variety of food items in these areas, and the nation will be able to guarantee consistent food security. To make agriculture a sector that benefits the people, the state, and the private sector, however, as well as to make it competitive, some barriers must be removed. Based on an analysis by the World Bank, there are five major obstacles standing in the way of accomplishing this goal right now.

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