As we see from the fig. 1 at the period 1926 to 1960–1965 water volume at the hydro station Samanbay was relatively unchangeable and shuttled between 30 to 65 km ^{3}. Later connected with reclamation of enormous irrigating territories at mid and down stream of the river the volume of outgoing river water started to increase.

As it was mentioned above the main reason of runoff volume change of the river Amudarya during the vegetative period (April-October) mainly depends of two factors:

– water gates from the river (main factor);

– climate index changes.

At the period of 1926–1967, which embrace first three periods the volume of first factor (water gates for irrigation) was minimal. That's why river stream volume was relatively stable (with succession of full water and insufficient water years). Later started from 1967–1970 its volume decreased connected with the increasing of water gates for irrigation.

Maximum sizes of water gates noticed during the period of 1972–1985 and later during 1986–2005 its sizes became stable even during last years appeared to be a bit decreased.

According to researchers' anticipations in perspective at the period 2015–2025 is expected insignificant decrease of water gates for irrigation (in case insignificant or unchangeable sizes of irrigated area). For achieving this it is necessary a development and implication of water saving technology in the region.

What concerns to air temperature changes, so could be added that in future expected its incensement.

Conclusion:

The analyses of database on climate change indexes and river runoff shows the following:

1. Amudarya river runoff changes could be occurred affected by climate change factors which is mainly air temperature, and the water gate sizes out flowing from the river for irrigation could be stable or even decreased if in future water saved technology would be implied over the whole region.

2. In future, during 20–30 years is expected river runoff incensement due to air temperature grow, which will take place simultaneously with decreased glaciers and finally future decreased of the volume of the river streamflow.

3. We must take into consideration that global climate change is unavoidable and ceasing these processes demand enormous efforts with integrated activities and long period for results. However, must be taken steps to study air temperature growing on local and regional scale. Such activities are quite available and they will stop huge territory desertification, will develop sand fixation and create man-made wetlands and other processes.

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Water resources: the basis for the socio-economic development in the lower reaches of the Amudarya: a case study of Karakalpakstan

Abstract: The article analyzes the socio-economic situation of the lower reaches of the Amudarya river, caused by the shortage of water resources in the region. Studied in detail the condition and use of water resources in the region, identified the existing problems and on their basis conclusions are given.

Keywords: water resources, involvement, hydrological regime, water intake, flow decrease, agriculture, available water supply of the territory.

Introduction. The fate of the Priaralie region and further agricultural development in the lower reaches of Amudarya depend entirely on the water policies of Tajikistan, Uzbekistan and Turkmenistan. The emergence of a critical water situation during low water years (2000–2003), when the water availability in the upstream and middle-stream of the river fluctuated in the range of 80–85 %, and declined to 16 % in the northern regions of the Republic of Karakalpakstan, is evidence of this dependence. In low water years, ecological objects and agriculture in the lower reaches of Amudarya suffered from the lack of water in low-water years, whereas in the high water periods a critical situation emerged due to dam and structures breakages in the river delta.

The main causes of the emergence of such situations are:

- Lack of integrated policy on water resources management along the Amudarya River.
- Inconsistent operation regime of large reservoirs, such as Nurek and Tuyamuyun.
- Lack of accurate accountability of water withdrawal volumes along the river.
- No recognition of ecological water requirements of the river delta and the Aral Sea by the states.

The reduction in inflow of the river run-off to the Priaralie region has caused huge socio-economic damage, associated with deterioration of the environmental situation and loss from agricultural production resulting from the shrinkage of crop areas and decline in crop yield.

Results and their discussion

Socio-Economic Damage Caused by Aggravation of the Ecological Situation

The reduction in water supply for the lower reaches has resulted in the following unfavorable outcomes:

- Loss of the Aral Sea;
- Losses in fisheries, muskrat breeding and livestock sector;
- Irreversible character of natural changes due to the desertification of the river delta;
- Creation of a new desert area on the dried bottom of the Aral Sea, which results in salt and dust transport to irrigated lands;
- Loss in recreational value of the sea.

Decrease of the Aral Sea Level

Although great efforts and policies on the stabilization of the sea level have been undertaken, decisions concerning the guaranteed water supply to the sea remain difficult to fulfill. In these circumstances, it should be acknowledged that if water allocation and use policies in the Aral Sea basin remain the same, the sea level will continue to fall. At present, the water is discharged into the sea on the residual principle. This means that one can expect an entire extinction of the sea in the future if no measures are undertaken (The Aral Sea Expedition — 2004, EC IFAS, Dushanbe, 2005).

A two-stage approach should be applied in order to deal with the Aral Sea problem: In the initial stage (stage I), a project should be developed with the involvement of interested donors (IFAS, GEF and others.). Meanwhile, feasibility studies aiming at determining the future of the Aral Sea are to be carried out based on project outcomes. If the project justifies saving the sea in a reduced, yet stable basin, then it can proceed to Stage II which aims at reaching an interstate consensus on the shared contribution of each republic to the amount of water that will be supplied to the sea. Since the future of the Aral Sea entirely depends on the policies of Central Asian countries, it will be necessary to clarify the following positions:

- Whether the Aral Sea is considered a problem by all Central Asian states, and if it should be solved;
- Will all Central Asian countries agree to direct water saved in their territories to the Aral Sea;
- Will Central Asian countries agree to allow Basin Water Organization (BWO)"Amudarya" and BWO "Syrdarya" to take full responsibility for guaranteed water supply (according to limits) to Priaralie and the sea.

Losses in Fisheries and Muskrat Breeding

Before 1970, there were 34 species of fish inhabiting in the Aral Sea. Of these, more than 20 species were caught. At the same time, the sea supplied more than 4500 ton of commercial fish, among which valuable species were prevailing. They included thorn, pikeperch, silurus, aral barbel, and carp. The Aral Sea ranked first in the former Soviet Union in terms of fish catch. Currently it has lost its importance as a fishery resource.

In 1957–1958, more than one million units of valuable muskrat skins were obtained from lakes in the lower Amudarya. However, after the critical low water years of 2000–2001, their population has completely disappeared.

The coastal zone has lost its vital attractiveness and landscape value, due to decreasing water volume in the lower reach of the river. By now, the area of lakes in the Amudarya delta has declined from 300,000 to 40,000 ha. Moreover, mineralization of water has sharply increased and in some places, water contains up to 60 g/l of dissolved solids (Lake Agushpa).

Increase in the Area of the Dried Bottom of the Sea

As the natural landscape zone of the Amudarya delta with its tugai flora and specific wildlife degraded, wildlife numbers fell sharply. The salt-dust from the dried sea bottom together with the declining sea level resulted in desertification and a decrease in natural bonitet of lands in large territories. The reed areas that were used as the main pasture areas for livestock were sharply reduced (30-fold). The intensive process of drying up of the sea initially took place in the sea bays Jiltirbas and Adjibay. The speed of coastline regression in Jiltirbas bay zone was 2.7–3 km. annually. The intensive drying process corresponded to the period 1980–1985 and its area accounted for 2,387 km^2 (in the south).

Assessment of Loss in Agricultural Production

From 1965 to 1996, the total area of irrigated lands increased from 220,000–500,000) ha, while rice crop area increased from 5,400–110,000 ha in the Republic of Karakalpakstan. During some years, 448,500 t of cotton and 368,300 t of rice were produced. In low water years a 35, 3 and 30 — fold decrease was observed in the areas of irrigated land, cotton and rice respectively.

The value of gross yield of crops depends on water availability. The production of the highest and most stable yields correspond to the period from 1983 to 1993, when water availability in the river was enough to meet crop water requirements. During this period, the average values of gross cotton and rice yields amounted to:

- Cotton: 337,500 ton;
- Rice: 301,000 ton.

Meanwhile in low water years, the shortfall in yield fell to 250,000 t. (Fig. 1).

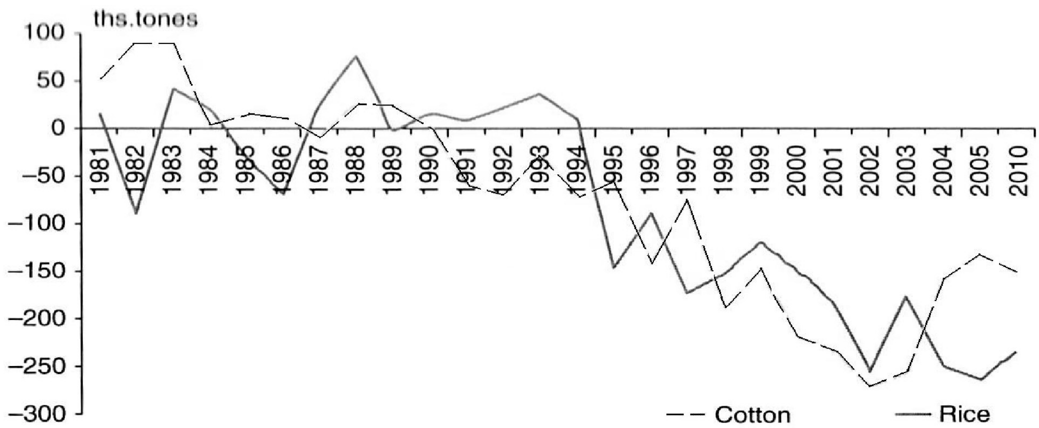

Fig. 1. Losses in the gross yields of cotton and rice in the Republic of Karakalpakstan for the period 1981–2010

For ecological objects and the agricultural sector only, the losses caused by water shortages amount to 219.8 million USD in low-water years, 164.3 million USD during average water availability years and 144.8 million USD in high-water years. For mitigating unfavorable ecological conditions and the socio-economic situation in the lower reaches of Amudarya, it is necessary to make decisions at a regional level.

The main conclusions:

- Development of a long-term concerted policy for Central Asian countries on water supply to the Priaralie region, on the principle of existing international counterparts.
- Increasing the role authority of BWO "Amudarya" by transferring all water withdrawal objects, large water works and reservoirs to the balance sheet of this organization so it can ensure a guaranteed water supply to Priaralie region.
- Further increase in agricultural production in the Aral Sea basin should be achieved by increasing the efficiency of irrigated hectare, rather than land reclamation.

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Step-by-step mechanical treatment of the dried grapes and its physical interpretation

Abstract: The gradual processing of dried grapes in the drum-typed grapes stemming machine ensured in the form of separate graph, which is implemented in the sequence of the technological process cycle. Partial grinding in a blade dozing unit, screw conveyor, in dismembratore, blade-brush area and the final separation of a crushed grapes mixture in the aerodynamic flow. Testing of the stemming machine showed that the purification ratio amounted 0.95, but the defectiveness of berries less than 4 %.

Keywords: grapes, raisins, drying, processing, stemming machine drum, dismembrator, disc, fingers, blade.

Uzbekistan is the in leadership position among the former Soviet Union countries on production of the dried grapes products. As in 2015 it there were produced the raisins in amount of 63.5 thousand tons, and by 2020 its production volume should be increased to 100 tons when the population of Uzbekistan is 31.5 million people and 3.17 kg. of product will be equal per capita [1]. Regardless the drying method (an air, a sun, sun drying method or kiln (artificial) drying the dried grapes are delivered to the point of primary processing and machine treatment by means of the technical means.

In the result of the scientific research activities carried out by the Gulistan State University staff a modernized drum typed high-tech stemming machine based on the impact-centrifugal effect has been developed (Fig. 1) [2].

Stemming machine consists of the following: shown in the fig. 1 — rotating drum inside surroundings of which the blades 3 are fixed at radial side; eccentrically at the axis 4 two couples of the outline-typed 5 and brush-typed 6 drums. The last ones are activated by means of the electrical engine 7 and wedge-belt 8. The main drum 2 is rotated at the account of frictional drive 9 and chain drive 10. At the loading area of the drum's head the rotor is installed coaxially, that represents dismembratore consisting of the internal stationary disc 11 and externally mounted disc 12, which is installed with possible rotation from the electrical engine 13. Throughout the peripheries, the fingers 14 are installed at concentrically surroundings on the discs fabricated from the elastic-distorting material, e. g. a rubber. The both discs form the ring tolerance to where the tray railing 15 of the screw conveyor machine [4] is directed to of the conveying machine 16 connected to the feeding blade-typed dozing unit 17 is the junction with the silo 18. The pneumatic separator 19 is mounted under the outlet of the drum end point.

Processing of a dried grapes can be ensured in the form of separate graphs, which is implemented in the sequence of the technological process cycle (fig.2) [3].

The dried grapes is supplied through the steeply-sloping bucket elevator into the feed silo 18 and then from the silo it is delivered through feeding blade dozing unit into the screw-typed conveying machine 16 in dose parts. When passing through the dozing unit and moving throughout the screw-typed conveying machine a racemation of the dried grapes are partially grinded until it becomes to separate grape berries and penicils.

Furthermore, the formed heavy multicomponent grapes mixture is supplied throughout the sloped blade *15* to the dismembratoring unit of the stemming machine. In this processing unit a product is delivered into the ring-typed tolerance formed between movable 12 and stationary *11* discs of dismembratoring unit; it hit onto the fingers *14* and grinded until it becomes the separate grape berries, combs and fruit stems.

Then the three-component dried grapes mixture is delivered to the slatted zone where it passes through the additional mechanical treatment. In this case mixture is caught by the blades *3* and at the top part is overturned to the side of being rotated slatted drums *5*. When it hits onto the bars and in process of flying-out of the certain berries of fruitstems flying-out are torn-off. Then the torn-off berries together with fruitstems are delivered into the brushed-type drums 6, where due to the brushes friction throughout the inside part perforated surface of the drum *2* there occurs the final tear-out dividing of the fruitstems.

Torn-off berries and stalks fall through the drum sieve into the sloped chute and supplied to the aerodynamic separation process. Thereafter the separation occurs under the influence of the sloped