

Increasing Water Productivity of Winter Wheat in the Pasture Soils by Means of Optimization Irrigating Regimens

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Abstract: *Water scarcity became the most topical problem of agriculture production in Uzbekistan. Main reason of water scarcity is depletion of stocks under influence of climate change, increasing number of population and industry development. Calculations had showed that in Uzbekistan water consumption of agriculture production is very high but productivity low. One of the main agriculture products is winter wheat and our experiment results allowed us to declare that by means of improving irrigation regimes it is possible increasing water productivity, economic efficiency of wheat production.*

Keywords: water scarcity, winter wheat, pastures soil, plough up, feeding water, productivity, net profit

1. Introduction

Climate changes in the world nowadays conditions to revise water productivity of winter wheat in agriculture production and developing new methods of irrigation regimes which allows reducing water consumption and ensure normal economic efficiency. Uzbekistan's agriculture sphere is very sensitive on water supply changes, because a husbandry in the country totally depends on artificial irrigation. That is why a notion made by Robert G. Evans and E. John Sadler about that "at present time in the world observing shift from maximizing per unit land to maximizing per unit productivity consumed water" is one of the topical problems for Uzbekistan's agriculture sphere [9].

Nowadays Uzbekistan annually grow up 8 million ton a wheat and in future this volume will increase because there is a possibility of export exceeded volume of wheat product to the abroad. Of course increasing a volume of the growing up wheat requires ensuring its quality because this question linked with increasing economic profit and competition ability in the foreign markets. In Uzbekistan husbandry cultures mainly concentrated in the irrigated land zones (98%) and growing up harvest (98%) too. In Uzbekistan annual averaged volume of taking water is consisting 60 billion cube meter and 90 % of its are using for purposes agriculture products production and the remain part for satisfying population needs and demand of the other branches of national economy. It is worthy to underline that increasing a number of the country population and settling new industrial plants brings to increasing demand on water resources. Fujihara et al. pointed out that water deficit will not occur if demand on water will not increase [5]. But, in Uzbekistan every year number of the industrial plants is increasing and population growth relatively high (1.5-1.7%). Besides, depletion water resources of the mountains under influence of climate change increase degrade of water stocking. In this situation Uzbekistan has only one option for improving water use productivity: implementation new methods of watering without expanding irrigated lands use. Thus, it is very urgent to determine the impacts of climate

change on crop production and water resources in Uzbekistan in order to develop possible adaptation strategies.

Future development of the Uzbekistan's economy depend on the economical using of the national water resources and ensuring demand of the population on fresh water and with other consumer goods conditions paying a special attention on increasing productivity of pasture lands with using modern technologies of irrigation. Today it is obvious that deficit of water resources in the region and further growth of agriculture production require more water ones. In near future it is expecting worsening water resources supply even in the case of economical using. Positive solving of this problem is supposing to take into count soil and hydrogeological conditions of the specified land areas, type of the plant and its biological features, improving irrigation technologies of agricultural products. That is why it is important to develop and to implement scientifically justified irrigation methods.

In this article our goal is learning conditions of irrigation of the winter wheat in Chirchik - Ohangaron volley of Tashkent region of Uzbekistan taking into count volume of atmospheric precipitations and ground waters. In the research process it was studied influence different ways of irrigation regimes on underground waters, saplings density of winter wheat, its growth and development, productivity and quality of grain. It was defined demand on water of the plants coming of growing periods and its structure, developed new coefficients winter wheat for this case and estimated economic efficiency of the different regimes of irrigation.

2. Methods of research

Research experiments were conducted in the study and practice fields of the Tashkent state agriculture university during 2012-2014 years. A soil of the experimental fields average civilized irrigating pasture ones from ancient periods, none mineralized ground waters located in the 1,5-

1,8 meter depth. A bed of the arid humus 1.784%, common nitrogen 0.183 and phosphorus 0.161 and potassium 1.07% consisted accordingly. A 1 m.larid field marginal intensity of moisture (FMIM) was equal to 22.27%, volume mass 1.39 sm³ and water trans missive capacity for 6 hour was 805.5 m³ per ha. In the period of experiment, for instance during 2012-2013 water supplies was low then from averaged level and in 2013-2014 years moderate.

In the experimental researches had been studied the next irrigation regimes of the autumn wheat “Kroshka”.

1. Giving Q feeding water before ploughing;
2. Irrigation before ploughing;
3. Giving feedings water.

In this variance form tube winding until milk – wax maturing phase soil moisture ensured before watering to relation FMIM was 80% and in the full maturing phase on the level 65%. In 1-2 and 3-variances before ploughing the land supposed giving water and in 1-variance before watering soil moisture of winter wheat ensured in the period of growing was 70-70-70%, in 2-variance 80-80-80%, and in 3-variance 70-80-65%. Field researches was conducted based on the common soil water – physics features, depth of ground water location, water measuring works, phenology observation and biometric measure, agrichemistry features of the soil.

3. Results and Discussion

Accordance of the research circuit, in the 2012-2013 season before of ploughing vegetation was on the rate 614 m³/ha. In the 1,2,4,5 and 6-variances 608 m³ and in 3-variance in the criterion 1117 m³/ha (13-14.XI) feeding water had been gaved. In the 2012-2013 years period these variables were accordingly 765 m³/ha (5.XE) and 613 m³/ha and 1176 m³/ha and (23.24.X) and in the period of 2013-2014 years accordingly 707 m³/ha (13.X) and 872 and 1020 m³/ha (4-5.XI). Coming of the annual weather changes, number of the winter wheat watering, seasonal vegetation and the one time irrigation was different. In the 2012-2013 years when a volume of the bad weather was small, wheat was irrigated in

the variances 1, 2, 3 two times, seasonal watering criterions were 2170 and 2011 m³/ha, in the variances 4-6 three times and criterions accordingly 2136, 2239, 1763 and 2032 m³/ha. In the fifth variance vegetation was conducted four times (2165 and 2442 m³/ha). In the period of 2013-2014 years when moisture level was relatively high, in the variances 1, 2, 3 one times (1351 m³/ha) and in the variances 4 and 6 two times (1359 and 1239 m³/ha) and in the 5-variance three times (1717 m³/ha). This watering order had allowed us to distribute soil moisture before vegetation according of the criterions circuit accepted in the experimental fields.

Winter wheat water consumption had consisted different rates coming of the conditions of weather in all variances of irrigation. In the sixth variance of experiment during in the first two years when moisture of soil was medial common spent volume of water per 1ha was equal to 7321-7855 m³/ha, and from its 39.6-41.2 % were aerosphere settlings, 25.5% watering and 7.6% underground water and 6.4% had covered by natural moisture of the soil. In the sixth variance of experiment winter wheat demand coefficient on water consisted 153.1-204.8 m³/ha and defined that it was less on 46.7-65.4 m³/ha than in the 4-5 variances. In the second variance soil was watered before arable the land but feeding water not gave and in the period of growing wheat was irrigated only two times, a demand on water was very small. Nevertheless, it was observed reaching a coefficient of the demand on water until 199.8-290.0 m³/ha. Accordance of the three years field experiments results, calculated Bioclimatic coefficient of the winter wheat suggested by A.A.Alpataev defined that in the period when water deficit consisted 90-100 mm coefficient was equal 0.75 to 150 mm and in the period 150 mm and above it was 0.35.[1] In this situation, it was determined by us coming of field experiments common seasonal watering criterions of real and bioclimatic coefficients are very close to each other. In the field experiments the lower height of the plants (76.6-79.3 cm) was determined in the fields where watering was not conducted before arable and irrigation done only two times in the growth period that is in the second and third variances of experiment (Table).

Table: Watering regimes results of winter wheat experiment and its productivity in Tashkent region of Uzbekistan

Variance №	Length of the section	Length of the ear	Number of pellets of ears	A weight of the 1000 pellets	Crop an ear		Straw cut down		Volume of water spent for 1 hundred weight pellet	
					c/ha	additional	c/ha	Additional	2012-2013	2013-2014
1	84.6	8.2	40.6	41.5	43.0	-	54.0	-	47.9/80.7	31.5/68.3
2	76.6	7.1	35.8	35.3	35.2	-7.8	44.0	-10.0	56.5/78.0	37.1/56.5
3	79.3	7.5	38.4	37.3	37.2	-5.8	46.6	-7.4	53.8/85.0	35.3/61.9
4	87.9	8.8	42.7	43.1	46.1	3.1	57.8	3.8	49.4/79.8	29.1/36.3
5	101.1	8.9	42.8	42.5	46.9	3.9	58.7	4.7	52.9/82.7	36.1/69.2
6	96.7	9.1	43.7	43.9	49.4	6.4	61.5	7.5	42.2/70.7	24.7/56.1

The explanation: in the numerator calculated watering only in the period growing and in the denominator before plough up and criterions for growing wheat irrigation.

*Source: author calculations

The best results were achieved in the 6-variance: a weight of the plant 96.7 centimeter and length of the ear's 9.1 centimeter, a number of the pellets in one ear 43.7 pieces, a weight 1000 pellets consisted 43.9 gram. In the 5-variance a weight of the plant though was 101 centimeter but morphological indicators of the ear were relatively lower

and predisposition to lie down has increased. Thus, watering before plough-up and giving feedings water, and applying irrigation order which ensure a soil moisture relation to FMIM on the level 70-80-65 % allowed to receive the best harvest from winter wheat. In this variance during experiment years 48.2-50.2 hw/ha (hw-hundred weight) or

with comparing control variance 12.7-17.0 % more wheat harvest was received. In another variance with the same conditions but soil moisture was ensured regarding to FMIM 70 and 80 % was received a harvest with 45.3 – 47.6 hw/ha (5.4-11.0 hw more harvest than in control variances). None watering before growth period and don't giving feeding water brought to receive less harvest on 10.7-24.0% than in control variances.

The most good variance in which was achieved the best results - watering before plough – up and giving feeding water, and an irrigation order in the period of growing soil moisture relatively to FMIM was ensured 70-80-65%. In this experiment variance it was received harvest 43,5 – 46,9 hw/ha or 13,3-17,0% more crop than in control variance. In the variance when soil moisture relatively to FMIM was 70-80-65% and irrigated before plough – up and feeding water economic efficiency (net profit) was 40590-47920 Uzbekistan sum/ha, and in the variance when soil moisture was 80-80-80% - 26570-31940 Uzbekistan sum/ha and in the variance when soil moisture was 70-70-70% - 21280-26779 Uzbekistan sum/ha. Accordance of the above described results, it was spent 42,2-24,7; 52,9-36,1 and 49,4-29,3 m³ water for growing 1 hundred weight autumn wheat. Low economic efficiency of winter wheat and the most big water expenses was observed in the second and third variances.

4. Conclusions

In Tashkent region in the pasture soils in order to grow up winter wheat before 10-12 days plough – up on the freed fields after reaping cotton crop it is necessary by using old beds to water with criterion 600-750 m³/ha. And after sowing in order seedlings grow up normally it is necessary giving feeding water on the beds with 70 cm depth and 600-850 m³/ha criterion.

In the years when medium soil moisture ensured winter wheat should be irrigated in the period of growing 3 times with 550-750 m³/ha gall, 1760-2100 m³/ha in the seasonal criterion and in the years when moisture level is high 2 times with 550-750m³/ha gall and 1200-1300 m³/ha seasonal criterion match with purposes.

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