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# EFFECT OF DETONATION SOIL SOFTENING ON CARBONATE AND SULFATE SALTS

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**Abstract:**
The article presents the changes in carbonates and sulfates, calcium, magnesium in irrigated arzik-shokh layered meadow saz soils of Central Fergana under the influence of detonation treatment.

**Keywords**: shock wave, loosening, soil cultivation, atmospheric carbon, calcium, magnesium, carbonate, sulfate.

Most of the irrigated lands of our republic have varying degrees of salinity. For example, as a result of repeated use of natural or agricultural machinery in the soils of the Central Fergana region, and due to chronic irrigation, soil particles have become excessively dense in the layers where the main roots of plants grow.

Breaking up such dense layers is very complicated and requires a lot of money and energy. That is why this issue is currently a problem. Nevertheless, deep drilling devices are used to soften these layers later. These methods, in turn, require large costs and energy consumption, as a result of which this processing is very expensive.

To solve this problem, the scientists of Fergana Polytechnic Institute created a device for drilling cylindrical holes using gas-dynamic waves.

In this device, the mixture of fuel and air creates a shock of detonation waves in the pipes. Detonation waves, in turn, serve as the main working body in drilling cylindrical holes in the vertical direction. The operation of the detonation wave generator can be explained as follows: the fuel-air mixture is transferred to the combustion chamber. The combustion chamber consists of a ribbed pipe with an inner diameter of 50 mm. From the beginning of the chamber, there is a device that brings the fuel-air mixture, a flame arrester valve, and the flange at the end is connected with a smaller diameter pipe. In the combustion chamber, the spark plug electrode from the control system, which starts the operation of the generator, ignites the fuel-air mixture under the influence of a high-voltage electric pulse with a frequency of up to 50 Hz. For spark protection at high gas flow, the spark plug is placed in a futorka on a cylindrical screen. The flame goes to the turbulizer, which accelerates the flame. The drive pipe consists of a 3 m long, 25 mm internal diameter metal standard pipe (Fig. 1).

The mixture preparation system is designed to create a mixture of gasoline and air in a specified composition and transfer it to the working organs.
A detonation tube with its open side directed to the ground and entering in a vertical direction digs a cylindrical hole. According to experiments, the digging speed is equal to 1.5 m/min.

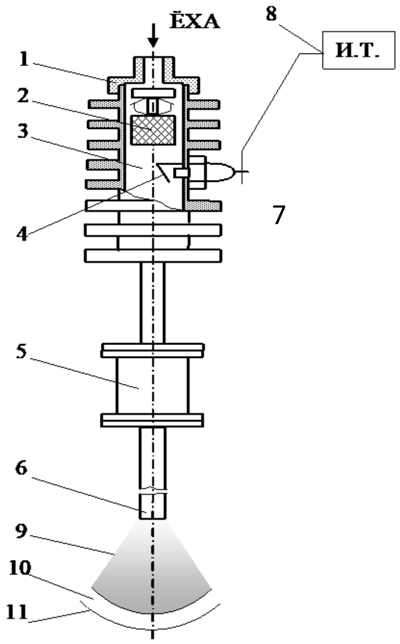


**Figure 1. Detonation wave generator scheme.**

1-fuel air mixture transfer device, 2-flame stop valve, 3-combustion chamber, 4-fuel, 5-spark plug, 6-turbolizer, 7-pipe, 8-alarm sensor, 9-burnt gas, 10-detonation shock, 11-soil.
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Due to the fact that we focus on calcium and magnesium carbonates in the research, 17 kg of $CO_2$ (carbon dioxide gas) and 8 kg of additional water per hectare are assumed to be added to the options. , naturally preserved. 2.7 for the second, third, and fourth options; 5.4; 8.1 kg of water is introduced, exhaust gas $CO_2$ and water vapor from the combustion of Ai-80 gasoline are added to the soil in a very small amount of benzapyrene and lead[1].
If we study the gas phase of the soil, the concentration of $CO_2$ gas in the soil environment increases under the influence of detonation waves, it should not be

forgotten that the amount of $CO_2$ gas in the soil is around 0.3-1.0%, which is less than oxygen. The change of this amount depends on the weather, humidity, organic matter of the soil, type of plants, character, etc.

The soil is constantly absorbing oxygen and releasing $CO_2$ gas. This situation depends on the decomposition of organic substances, some chemical reactions, and the activity of microorganisms. Under normal conditions, the amount of $CO_2$ gas in the surface atmosphere increases and improves photosynthesis, resulting in increased plant productivity. As a result of the reaction of $CO_2$ gas with the liquid phase of the soil, the amount of H+ and $HCO_3$ ions in the soil increases.

The increase of carbon dioxide in the atmosphere and soil environment, in turn, increases its solubility in water. The concentration of H+ and $HCO_3$ ions in the solution increases, as a result, the solubility of soil phosphates and carbonates increases at the same time. Therefore, the level of phosphorus supply to the soil increases, resulting in improved productivity and quality of the crop.

It should not be forgotten that an increase in $CO_2$ gas in the soil leads to a decrease in $O_2$ oxygen. This, in turn, leads to an increase in rebound reactions. Therefore, it is necessary to increase and maintain $CO_2$ gas in moderation. Soda can also be formed at the same time.

Carbon dioxide is one of the last products in the mineralization of petroleum products. It accumulates and emits water in the soil regardless of its water structure, i.e., automorph, hydromorph, semi-hydromorph, etc. In this case, the carbon balance in the soil is disturbed, the emission of carbon dioxide depends on a number of soil-climatic and anthropogenic factors. Under normal conditions, a decrease in soil moisture increases the emission of $CO_2$ gas, on the contrary, i.e., an increase in humidity decreases this process. This is a simple process where increased water content in the soil increases the binding of $CO_2$ gas, increasing its accumulation, while reducing the amount of oxygen.

In the process of building the soil, this gas begins to leave the soil at a rapid rate, but even then, wet soil absorbs and absorbs more $CO_2$ than dry soil. The chemical reaction of this situation can be described as follows: $CO_2+H_2O \rightarrow H_2CO_3$, as a result of which the alkalinity of soil water increases, albeit slowly.

A similar situation can occur in the physico-chemical nature of carbonates in the soil, i.e.: $CO_2+HOH \rightarrow H_2CO_3$; $H_2CO_3+CaCO_3 \rightarrow Ca(HCO_3)_2$; $H_2CO_3+MgCO_3 \rightarrow Mg(HCO_3)_2$

As a result of soil drying, the mentioned reactions go in the opposite direction, $CO_2$ gas is released from the soil and carbonate minerals are formed. Of course, living organisms and microorganisms also play a role in the migration of carbon dioxide. It should be noted that $CO_2$ gas is a permanent component of soil gas. This gas is of great importance in the nutrition of plants and in the air regulation of the soil. The movement and amount of gas can also clarify soil-forming processes.

According to the literature, 400-600 kg/ha of $CO_2$ gas is emitted and absorbed, depending on soil conditions. The main mass of $CO_2$ gas is related to biological and chemical processes. In addition, part of the $CO_2$ gas may come from hydrocarbonate seepage waters.

Carbonic anhydride amounts and movement in the soil, participation in chemical and biogeochemical processes are complex. Therefore, its amount in the soil is dynamic, that is, it varies from 0.03 percent to 20 percent. In this case, its amount in the uppermost surface of the soil is almost equal to the amount in the atmosphere.

From the above brief analysis, it can be said that the migration of $CO_2$ gas in the soil takes place in 5 ways. These include chemical, physicochemical, hydrate, biological, biogeochemical groups. In these groups, the migration of $CO_2$ gas is definitely interrelated and independent.

1. Carbonate, hydrocarbon balance and minerals are formed in the chemical process.
2. In the physico-chemical process, the migration of $CO_2$ gas occurs through the absorbing complex of the soil, that is, it is absorbed or released. This process takes place in the form of $HCO_3$. $CO_2+H_2O \rightarrow H_2CO_3$; $H_2CO_3+CaCO_3 \rightarrow Ca(HCO_3)_2$
3. The process of biological migration occurs through direct assimilation and dissimilation of $CO_2$ gas by living organisms.
4. The process of hydrate migration is close to chemical and occurs directly through the absorption and release of $CO_2$ gas by water, in which $CO_2$ gas dissolved in water is in the state of $HCO_3$, $CO_2$ gas is released into the atmosphere at evaporative barriers, and carbonate salts are will be planned.
5. Biogeochemical migration occurs in the processes of mineralization and humification of soil humus and other organic substances. In this case, $CO_2$ gas is released as the final product of mineralization. The above groups of $CO_2$ migration can be combined into a pedosphere type, since these processes take place in the soil and in the parent rocks in the soil-ground water.

Thus, there are many reasons for the change in the amount of $CO_2$ gas in the soil, one of them, according to N. Kholmanov [2], is that the amount of $CO_2$ gas in the soil can increase by 16-21% due to siderate plants. There are many anthropogenic ways to increase the amount of $CO_2$ in the soil, one of which is direct combustion of gasoline fuel to create a detonation wave and direct and inject it directly into the soil.

We have given above the quantities regarding impact of detonation waves on the soil. A part of the mentioned numbers remains on the surface mixed with air during contact with the soil surface, but the main mass spreads to the inner layers of the soil

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to a depth of 150 cm, and is distributed almost uniformly. The additional $CO_2$ gas, i.e. the anthropogenic amount, falling into the soil does not affect its properties, especially the amount of carbonates, theoretically and practically. We explained the theory of these processes above.

Now, if we pay attention to the changes of $CO_2$ gas and calcium and magnesium carbonates under the influence of additional $CO_2$ gas in direct options, they are presented below (in Tables 1).

**Table 1 Effect of detonation wave composition on soil carbonates and sulfates, % (2020)**

| Options | Depth, cm | $CO_2$-carbonates | $CaSO_3$ | $MgCO_3$ | $CaSO_4 \cdot 2H_2O$ | $MgSO_4 \cdot 7H_2O$ |
|---|---|---|---|---|---|---|
| Control | 0-32 | 7,10 | 3,38 | 3,70 | 6,11 | 6,20 |
| | 32-51 | 7,20 | 3,51 | 3,60 | 8,20 | 7,20 |
| | 51-90 | 12,20 | 5,50 | 6,65 | 17,80 | 10,30 |
| | 90-110 | 9,90 | 4,13 | 5,01 | 14,20 | 9,20 |
| | 110-130 | 8,60 | 3,87 | 4,70 | 12,10 | 9,10 |
| | 130-180 | 7,20 | 3,13 | 4,01 | 10,30 | 10,20 |
| xTGDYu-1xx | 0-32 | 7,11 | 3,40 | 3,77 | 6,15 | 6,21 |
| | 32-51 | 7,20 | 3,55 | 3,64 | 8,25 | 7,31 |
| | 51-90 | 12,15 | 5,80 | 6,76 | 16,80 | 10,45 |
| | 90-110 | 10,0 | 4,15 | 5,15 | 14,40 | 9,10 |
| | 110-130 | 8,61 | 3,90 | 4,90 | 12,15 | 9,15 |
| | 130-180 | 7,28 | 3,23 | 4,20 | 10,35 | 10,31 |
| TGDYu-2 | 0-32 | 7,15 | 3,55 | 3,91 | 6,13 | 6,25 |
| | 32-51 | 7,27 | 3,65 | 3,78 | 8,20 | 7,35 |
| | 51-90 | 12,45 | 5,93 | 6,81 | 16,70 | 10,51 |
| | 90-110 | 10,20 | 4,23 | 5,31 | 14,50 | 9,20 |
| | 110-130 | 8,70 | 4,01 | 5,01 | 12,25 | 9,15 |
| | 130-180 | 7,30 | 3,30 | 4,33 | 10,30 | 10,27 |
| TGDYu-3 | 0-32 | 7,20 | 3,61 | 4,01 | 6,15 | 6,24 |
| | 32-51 | 7,35 | 3,74 | 3,91 | 8,31 | 7,41 |
| | 51-90 | 12,60 | 6,01 | 6,98 | 17,25 | 10,41 |
| | 90-110 | 10,15 | 4,25 | 5,45 | 14,35 | 9,31 |
| | 110-130 | 8,75 | 4,10 | 5,10 | 12,20 | 9,20 |
| | 130-180 | 7,40 | 3,35 | 4,45 | 10,25 | 10,31 |

**x) Soil gasodynamic softener. xx) line of operations.**

According to the table, the amount of carbonates in the soil due to additional $CO_2$ gas, the air temperature is low, i.e. $0^0$ C at night; $-2^0$ C; $0^0$ C during the day; Due to the fact that it was $+2^0$ C, it decreased accordingly, but the water given for salt washing increased the dissolution of $CO_2$ gas and its participation in chemical processes. Ions such as Ca++, Mg++, Na+, $HCO_3$-, $SO_4$-- are typomorphic for saline soils, i.e. for the studied soils, in addition, carbonates are weakly leached from the upper layers during the leaching process and then accumulate .

In irrigated meadow sedge soils, especially the control part of the experimental options in option 1, when the total $CO_2$ carbonates fluctuated between 7.1 and 12.2%, $SaCO_3$ was 3.13-5.5%, and $MgCO_3$ was 3.13-5.5%. It fluctuates between 6-6.65% (Table 1). In the second option, 4.25 kg of $CO_2$ and 2.7 kg of water per hectare are distributed at a depth of up to 150 cm from the top of the soil, introduced as a detonation wave, as a result of which there are weak changes in soil carbonates, total carbonates 7,11-12,15 %, $CaCO_3$ and 3.23 to 5.80%, $MgCO_3$ has changed in the range of 3.64-6.76%, a slight increase is observed. This condition is felt in the upper parts. In the third option, these indicators are more clearly noticeable compared to options 1 and 2, that is, washing and accumulation are felt, and in option 4, you can see obvious washing and accumulation. The reason for the following cases is one, two and three standards for the above-mentioned soil, i.e. 4.25; 8.50; It is related to the amount of additional $CO_2$ added to the soil in the amount of 12.75 kg/ha.

In general, $CaCO_3$ and $MgCO_3$ were 45.1-47.6%, $MgCO_3$ was 52.9-54.9%, compared to the amount of $CO_2$. In the second option, these indicators are 45.0-47.1% and 52.9-55.0%, respectively, and in the 3rd option, respectively, 47.2-47.4%; In case of 52.6-52.8%, calcium carbonate in option 4, in case of 47.8-48.3% of total carbonates, magnesium carbonates fluctuate between 51.7-52.2%. Evidence of this change, albeit small, can be seen in the pH-soil environment, which is increasing towards a weakly alkaline side. The pH increases very weakly from the first option to the fourth option, if the pH is 7.1-7.2 in the 1st option, 7.2-7.4 in the 3rd option, 7.3-7.5 in the 4th option make up indicators in the range. If we look at these cases in 2016-2018, the following cases can be seen.

The state of carbonates after the 2020 salt wash from Table 2 shows that there are almost no changes between the options, the soil and its carbonates have returned to the previous equilibrium state for these soils, as shown by $CO_2$ carbonates and Ca, Mg can be seen in the amount of carbonates and in the soil environment. About these carbonates, it should be said that their weak migration A.I. Perelman [3] and G.I. Olovyanishnikov [4] but weak presence and accumulation in illuvial layers O.K. Komilov, V.Yu. Isakov [5] and others recorded.

Therefore, in the irrigated saline, rich-horned meadow saz soils formed in Central Fergana, under the influence of $CO_2$ gas added to the soil, total carbonates and calcium and magnesium carbonates gradually dissolve depending on the amount of added $CO_2$

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gas. it was proved for the first time that it increases in a small amount and accumulates in the illuvial layers and increases the pH.

The participation of $CaCO_3$, $MgCO_3$, $CaSO_4$, $MgSO_4$, $CaSO_4·2H_2O$, $MgSO_4·7H_2O$, as well as NaCl, $Na_2SO_4$, $K_2SO_4$ and other salts in the formation of Central Fergana soils has now been proven. This situation, in particular the processes of migration and accumulation of $CaSO_4·2H_2O$, $MgSO_4·7H_2O$ in these soils are presented in Tables 2.

**Table 2 Changes in carbonates and sulfates, % (2020)**

| Options | Depth, cm | $CO_2$-carbonates | $CaSO_3$ | $MgCO_3$ | $CaSO_4.2H_2O$ | $MgSO_4.7H_2O$ |
|---|---|---|---|---|---|---|
| Control | 0-32 | 7,01 | 3,31 | 3,65 | 6,01 | 6,11 |
| | 32-51 | 7,11 | 3,50 | 3,50 | 8,11 | 7,10 |
| | 51-90 | 13,10 | 5,56 | 6,77 | 17,98 | 10,41 |
| | 90-110 | 9,85 | 4,15 | 5,00 | 14,21 | 9,21 |
| | 110-130 | 8,70 | 3,80 | 4,65 | 12,20 | 9,00 |
| | 130-180 | 7,21 | 3,15 | 4,10 | 10,35 | 10,31 |
| [x]TGDYu-1[xx] | 0-32 | 7,09 | 3,29 | 3,60 | 5,80 | 5,90 |
| | 32-51 | 7,10 | 3,41 | 3,40 | 8,00 | 6,90 |
| | 51-90 | 13,01 | 5,71 | 6,81 | 18,10 | 10,21 |
| | 90-110 | 9,80 | 4,10 | 5,03 | 14,10 | 9,01 |
| | 110-130 | 8,70 | 3,75 | 4,60 | 12,11 | 8,80 |
| | 130-180 | 7,11 | 3,15 | 4,01 | 10,20 | 10,01 |
| TGDYu-2 | 0-32 | 7,01 | 3,25 | 3,54 | 5,80 | 5,86 |
| | 32-51 | 6,95 | 3,36 | 3,41 | 8,00 | 6,90 |
| | 51-90 | 12,95 | 5,78 | 6,90 | 18,15 | 10,14 |
| | 90-110 | 9,75 | 4,08 | 5,03 | 14,11 | 9,03 |
| | 110-130 | 8,63 | 3,71 | 4,50 | 12,10 | 8,86 |
| | 130-180 | 7,01 | 3,10 | 4,00 | 10,15 | 10,03 |
| TGDYu-3 | 0-32 | 6,95 | 3,20 | 3,55 | 5,81 | 5,81 |
| | 32-51 | 7,00 | 3,31 | 3,35 | 8,01 | 6,87 |
| | 51-90 | 12,90 | 5,78 | 6,91 | 18,20 | 10,28 |
| | 90-110 | 9,70 | 4,01 | 5,01 | 14,01 | 8,91 |
| | 110-130 | 8,61 | 3,70 | 4,47 | 12,10 | 8,70 |
| | 130-180 | 7,00 | 3,10 | 3,97 | 10,10 | 10,01 |

According to the table, 4.25 per hectare is added to the soil in addition to the migration and accumulation of these salts; 8.50; After the 2016 and 2018 brine wash, the effect of 12.75 kg of $CO_2$ gas was barely noticeable. Small changes are among the characteristics of this soil. In the control option, the amount of gypsum is 6.15-17.25% in the 4th option, showing a minimum of 6.11% and a maximum of 17.80%.

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Similar changes are observed in $MgSO_4 \cdot 7H_2O$, i.e., in the case of the control option, this salt content is 6.2-10.20%, in option 4 it represents 6.24-10.31%. Similar cases were also observed in 2018, increasing the amount of $CO_2$ gas introduced to these soils before additional saline leaching did not affect the migration and accumulation of gypsum and epsomite salts.

Accumulation of salts due to irrigated agriculture is mainly due to two factors. One of them is the presence of salt in irrigation water. The second is the increase in the level of saline seepage water due to irrigation with water exceeding this standard and the poor functioning of the drainage system.

According to the thickness of the layer, it belongs to the group of low power. According to the composition of salts, it is of the type of chloride-sulfate salinity, corresponding to the weakly enriched group compared to the sum of gypsum and calcium carbonate in the boundary layer.

## Conclusion

In conclusion According to Table 1, the amount of carbonates in the soil due to additional $CO_2$ gas is low, i.e. 0°C at night; -2°C; 0°C during the day; Due to the fact that it was +2°C, it decreased accordingly, but the water given for salt washing increased the dissolution of $CO_2$ gas and its participation in chemical processes. Ions such as Ca++, Mg++, Na+, $HCO_3$-, $SO_4$-- are typomorphic for saline soils, i.e. for the studied soils, in addition, carbonates are weakly leached from the upper layers during the leaching process and then accumulate.

In conclusion According to Table 2, 4.25 per hectare in addition to the soil in the migration and accumulation of these salts; 8.50; After the 2016 and 2018 brine wash, the effect of 12.75 kg of $CO_2$ gas was barely noticeable. Small changes are among the characteristics of this soil. In the control option, the amount of gypsum is 6.15-17.25% in the 4th option, showing a minimum of 6.11% and a maximum of 17.80%. Similar changes are observed in $MgSO_4 \cdot 7H_2O$, i.e., in the case of the control option, this salt content is 6.2-10.20%, in option 4 it represents 6.24-10.31%. Similar cases were also observed in 2018, increasing the amount of $CO_2$ gas introduced to these soils before additional saline leaching did not affect the migration and accumulation of gypsum and epsomite salts.

## References

1. Ubaydullaev M.M.U., Askarov Kh.Kh., Mirzaikromov M.A.U. EFFECTIVENESS OF NEW DEFOLIANTS. Theoretical & Applied Science. 2021. № 12 (104). C. 789-792. https://www.elibrary.ru/keyword_items.asp?id=21526423

2. Назирова Рахнамохон Мухтаровна, Мирзаикромов Мирзабобур Алишер Угли, Усмонов Нодиржон Ботиралиевич Влияние процесса охлаждения зерна кукурузы на его сохраняемость, количество потерь и на заражённость насекомыми-вредителями // Проблемы Науки. 2020. №6-2 (151). URL: https://cyberleninka.ru/article/n/vliyanie-protsessa-ohlazhdeniya-zerna-kukuruzy-na-ego-sohranyaemost-kolichestvo-poter-i-na-zarazhyonnost-nasekomymi-vreditelyami
3. MUKHTAROVNA, N. R., UGLI, M. M. A., & BOTIRALIYEVICH, U. N. Use of Sugar Beet Waste in Livestock. JournalNX, 7(1), 181-186.https://www.neliti.com/publications/336293/use-of-sugar-beet-waste-in-livestock#cite
4. Mirzayeva, M. A., Mullajonova, S. S., & Mirzaikromov, M. A. (2022). THE GRAPE PROCESSING TECHNOLOGY FOR WINE PRODUCTION. International Journal of Advance Scientific Research, 2(04), 7-10. https://sciencebring.com/index.php/ijasr/article/view/43/33
5. Мирзаикромов М.А. ВЛИЯНИЕ ОРГАНИЧЕСКИХ И МИНЕРАЛЬНЫХ УДОБРЕНИЙ НА УРОЖАЙНОСТЬ ХЛОПКА // Universum: технические науки : электрон. научн. журн. 2022. 5(98). URL: https://7universum.com/ru/tech/archive/item/13724
6. Nazirova Rahnamohon Mukhtarovna, Usmonov Nodirjon Botiralievich, & Musayeva Iroda. (2022). Classification of Functional Products for Children's Food. Eurasian Journal of Engineering and Technology, 13, 36–39. Retrieved from https://geniusjournals.org/index.php/ejet/article/view/2904
7. Nazirova Rakhnamohon Mukhtarovna, Hursanaliyev Shohjaxon, & Usmonov Nodirjon Botiraliyevich. (2022). Apple Fruit Storage Technology. Eurasian Journal of Engineering and Technology, 13, 40–43. Retrieved from https://geniusjournals.org/index.php/ejet/article/view/2905
8. Nazirova Rakhnamohon Mukhtarovna, Makhmudov Nozimjon Nuriddin ugli, Usmonov Nodirjon Botiraliyevich. Technology of industrial storage of carrots. Web of Scientist: International Scientific Research Journal. Vol. 3 No. 6 (2022). pp 1455-1460. Retrieved from https://wos.academiascience.org/index.php/wos/article/view/2068
9. Nazirova Rakhnamohon Mukhtarovna, Aminjonov Hokimjon, Usmonov Nodirjon Botiraliyevich, Marufjonov Abdurakhmon Musinjon ugli. Production of alternative vegetable milk. Web of Scientist: International Scientific Research Journal. Vol. 3 No. 6 (2022). pp 1449-1454. Retrieved from https://wos.academiascience.org/index.php/wos/article/view/2067

10. Nazirova Rakhnamohon Mukhtarovna, Khodjimatov Javlon, Usmonov Nodirjon Botiraliyevich, Marufjonov Abdurakhmon Musinjon ugli. Complex processing of pumpkin fruit. Web of Scientist: International Scientific Research Journal. Vol. 3 No. 6 (2022). pp 1461-1466. Retrieved from https://wos.academiascience.org/index.php/wos/article/view/2069
11. Nazirova Rakhnamohon Mukhtarovna, Akhmadjonov Avazbek Akmaljon ugli, Usmonov Nodirjon Botiraliyevich. Rootstock growing technology. International journal of research in commerce, it, engineering and social sciences. Vol. 16 No. 5 (2022): May. pp 1-5. Retrieved from http://www.gejournal.net/index.php/IJRCIESS/article/view/442
12. Мухтаровна, Н. Р., Ботиралиевич, У. Н., & ўғли, М. А. М. (2021). Особенности Обработки Озоном Некоторых Видов Плодов И Овощей Для Их Долгосрочного Хранения. Central Asian Journal of Theoretical and Applied Science, 2(12), 384-388. Retrieved from https://cajotas.centralasianstudies.org/index.php/CAJOTAS/article/view/367
13. Mukhtarovna, Nazirova R., et al. "Study of the Influence of Processing on the Safety of Fruit and Vegetable Raw Materials." European Journal of Agricultural and Rural Education, vol. 2, no. 6, 2021, pp. 43-45. Retrieved from https://www.neliti.com/publications/378976/study-of-the-influence-of-processing-on-the-safety-of-fruit-and-vegetable-raw-ma#cite
14. Nazirova Rakhnamokhon Mukhtarovna, Tursunov Saidumar Islomjon ugli, & Usmonov Nodirjon Botiraliyevich. (2021). Solar drying of agricultural raw materials and types of solar dryers. European Journal of Research Development and Sustainability, 2(5), 128-131. Retrieved from https://www.scholarzest.com/index.php/ejrds/article/view/824
15. Nazirova Rahnamokhon Mukhtarovna, Akramov Shokhrukh Shukhratjon ugli, & Usmonov Nodirjon Botiraliyevich. (2021). Role of sugar production waste in increasing the productivity of cattle. Euro-Asia Conferences, 1(1), 346–349. Retrieved from http://papers.euroasiaconference.com/index.php/eac/article/view/110
16. Nazirova Rahnamokhon Mukhtarovna, Akhmadjonova Marhabo Makhmudjonovna, & Usmonov Nodirjon Botiraliyevich. (2021). Analysis of factors determining the export potential of vine and wine growing in the republic of uzbekistan. Euro-Asia Conferences, 1(1), 313–315. Retrieved from http://papers.euroasiaconference.com/index.php/eac/article/view/99
17. Nazirova Rakhnamokhon Mukhtarovna, Holikov Muhridin Bahromjon ogli, & Usmonov Nodirjon Botiralievich. (2021). Innovative grain reception technologies

change in grain quality during storage. Euro-Asia Conferences, 1(1), 255–257. Retrieved from http://papers.euroasiaconference.com/index.php/eac/article/view/79

18. Nazirova Rakhnamokhon Mukhtarovna, Tojimamatov Dilyor Dilmurod ogli, Kamolov Ziyodullo Valijon ogli, & Usmonov Nodirjon Botiralievich. (2021). Change in grain quality during storage. Euro-Asia Conferences, 1(1), 242–244. Retrieved from http://papers.euroasiaconference.com/index.php/eac/article/view/75
19. Nazirova Rakhnamokhon Mukhtarovna, Rahmonaliyeva Nilufar Nodirovna, & Usmonov Nodirjon Botiralievich. (2021). Influence of seedling storage methods on cotton yield. Euro-Asia Conferences, 1(1), 252–254. Retrieved from http://papers.euroasiaconference.com/index.php/eac/article/view/78
20. Nazirova Rakhnamokhon Mukhtarovna, Otajonova Baxtigul Bakhtiyor qizi, & Usmonov Nodirjon Botiralievich. (2021). Change of grape quality parameters during long-term storage. Euro-Asia Conferences, 1(1), 245–247. Retrieved from http://papers.euroasiaconference.com/index.php/eac/article/view/76
21. Nazirova Rakhnamokhon Mukhtarovna, Mahmudova Muhtasar Akhmadjon qizi, & Usmonov Nodirjon Botiralievich. (2021). Energy saving stone fruit drying technology. Euro-Asia Conferences, 1(1), 248–251. Retrieved from http://papers.euroasiaconference.com/index.php/eac/article/view/77
22. Nazirova Rahnamokhon Mukhtarovna, Akhmadjonova Marhabo Makhmudjonovna, & Usmonov Nodirjon Botiraliyevich. (2021). Analysis of factors determining the export potential of vine and wine growing in the republic of Uzbekistan. Euro-Asia Conferences, 1(1), 313–315. Retrieved from http://papers.euroasiaconference.com/index.php/eac/article/view/99
23. Nazirova R. M., Qahorov F.A., Usmonov N. B. Complex processing of pomegranate fruits. Asian journal of multidimensional research. 2021, Volume: 10, Issue: 5. pp. 144-149. Retrieved from https://www.indianjournals.com/ijor.aspx?target=ijor:ajmr&volume=10&issue=5&article=020
24. Mukhtarovna N. R., Alimardonugli S. A., Botiraliyevich U. N. Features of treatment of winter wheat seeds by different processors //International Engineering Journal For Research & Development. – 2021. – T. 6. – C. 3-3.
25. R.M.Nazirova, M.X.Xamrakulova, N.B.Usmonov. Moyli ekin urug‘larini saqlash va qayta ishlash texnologiyasi. O’quv qo’llanma. Фергана-Винница: ОО «Европейская научная платформа», 2021. – 236 с. https://doi.org/10.36074/naz-xam-usm.monograph

26. A.S.Abduraximov, N.B.Usmonov. Effectiveness of co-planting crops in sandy soils. Plant Cell Biotechnology and Molecular Biology (SCOPUS JOURNAL). 2020. 21(65&66). pp 1-9 https://www.ikppress.org/index.php/PCBMB/article/view/5688
27. N.B.Usmonov. Benefits of co-planting cotton with peanuts. 4th –ICARHSE "International Conference on Advance Research in Humanities, Applied Sciences and Education" Hosted from New York, USA, July 28th 2022. pp 90-92. https://conferencea.org/index.php/conferences/article/view/1040
28. N.B.Usmonov. Efficiency of co-planting of cotton and peanuts in sandy soils of the desert region. Web of Scientist: International Scientific Research Journal. ISSN: 2776-0979. Impact Factor: 7.565 Volume 3, Issue 7, July-2022. pp 458-461. https://wos.academiascience.org/index.php/wos/article/view/2228
29. N.B.Usmonov. Effect of seed germination of intercropping cotton and peanut. "International Conference on Developments in Education" Hosted from Delhi, India. 21st August 2022. pp 1-2. http://www.econferencezone.org/index.php/ecz/article/view/1423
30. N.B.Usmonov. Effect of Intercropping of Cotton and Peanut on Quantity and Quality of Soil Microorganisms. "Eurasian Scientific Herald" international scientific journal, Belgium, Volume 11, August 2022, pp 12–15. https://www.geniusjournals.org/index.php/esh/article/view/1990
31. А.С.Абдурахимов, Н.Б.Усмонов. Эффективный способ улучшения плодородия и питательного режима песчаных почв путём совместного возделывания хлопчатника с арахисом. Актуальные проблемы современной науки. Журнал. Москва. "Издательство "Спутник+" ISSN: 1680-2721. № 5 (128). 2022 год. Стр. 44-47. https://elibrary.ru/item.asp?id=49437042.