Agrotechnology of Melilotus albus cultivation in saline area

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Abstract. In order to organize a profitable agrotechnology for the cultivation of Melilotus albus in saline area, Melilotus albus’s Kibray variety and Tashkent-1 variety of common alfalfa seeds for comparative study in different versions were studied by sowing in 4 versions, different sowing norms. For each version, valuable farm traits during the vegetation, especially blue mass yield and hay yield were analyzed. Just like that, to each version economical effectiveness was studied. In saline areas has been identified an effective version of the sowing norm Melilotus albus.

1. Introduction
Great attention is paid to increase the number of livestock and its productivity as well as feed base on the resolution of the president of the Republic of Uzbekistan dated April 21, 2008 № PD 842 “On additional measures to strengthen incentives for livestock breeding on private and subsidiary peasant and farms as well as to expand livestock production”.

In the implementation of agricultural reforms in the irrigated fields of the Republic have been established farms and many livestock farms. For growing fodder crops in livestock farms have been allocated lands for strengthening the fodder base. However, the volume of saline lands in the Republic is exceeding in recent years.

Also, it requires increasing soil fertility in Uzbekistan to getting high yields of cotton, wheat and other crops. This can be achieved through the proper introduction of crop rotation and the sowing of alfalfa and other legumes.

Melilotus albus is a plant that provides nutritious food, from it quality hay, haylage and silage are made. One kilogram of green contains 17-15 g of protein and 0.16-0.20 nutrient units. Melilotus albus is of great importance in agriculture because it is a resistant plant to drought, cold and salinity. It enriches the soil with nitrogen, reduces soil salinity and honey producing plant. Melilotus albus is of great importance in cattle breeding. \textit{Melilotus albus Med} is a perennial plant, taproot, stem erect, well branched, height 75-200 cm. The leaves are three-lobed, pubescent, round and oblong in shape. The flowers is located in the axillary bud, have flowers in the shaped of cluster. Legumes are small, single-seeded, small seeds, yellowish-green, 1000 seeds weight around 1.5 g [1-3].
Melilotus albus is a highly resistant plant to drought and salinity than alfalfa. Melilotus albus has the possibility to accumulate nitrogen into the soil deposit, blue mass, hay and seed crop in two years than common alfalfa in three years [1].

According to peculiarities, Melilotus albus is near to alfalfa, its resistance to winter drought is higher than of alfalfa, it requires a lot of moisture only in flowering period. If there is a lack of water during this period, the leaves fall off. Growing period is 85-140 days. It grows rapidly in the budding period; the daily growth is 3-5 cm. Growth begins in early spring. Flowering period lasts 14-15 days. The root, stem, leaf, flower and fruit contain coumarin aromatic (fragrant) substance. Melilotus albus is grown on lands free from various plants. Seeds are sown in early spring, 15-25 kg seeds per hectare are spent, sowing depth is 2-3 cm. Sometimes it is planted with other crops. During the flowering period hay is haymaking. Seeds are obtained from 1-2 haymaking. Collection begins when the legume reaches 30%. It can be crushed and cleaned in grain harvesters. The moisture content of the seeds up to 15% it is stored for a long time; seeds are prepared from one haymaking [2].

In the structure Melilotus albus plant a small amount of coumarin is found in pure form, the rest of glycosides of o-coumaric acid. Because it exists β–glycosidase enzyme in this plant. It rapidly degrades coumaric acid glycoside, but doesn’t affect o-coumaric acid glycoside.

Selection of complementary genotypes changes the traditional concept of the superior genotype [4], and the concept could be applied in future breeding schemes of M. albus. Mixture (blend) components are not generally selected based on genotypic complementarity, although there have been some breeding methods developed that support this approach [5].

On irrigated lands of Uzbekistan to increase the cultivation of food crops for blue mass haymaking, crop types were selected for rotation, the soil biological activity and crop productivity were studied [6, 7].

According to [8, 9], legumes play an important role in increasing soil fertility in cotton rotation annual. Tkachenko et al. (2006) [8] noted that the advantage of constant occupation of the land is that the nutrients that are washed away by precipitation and mineral fertilizers are completely preserved. Alfalfa reduces soil salinity, tillage, weeds, diseases, pests, softens the soil, protects it from erosion, and increases soil fertility with other positive properties. The process of seed formation of agricultural crops depends not only on their high quality, but also on soil climatic conditions and compliance with agronomic requirements and other factors.

2. Method
The aim of the work to organize a profitable agrotechnology for the cultivation of Melilotus albus in saline area, studying Melilotus albus’s Kibray variety and Tashkent-1 variety of common alfalfa seeds for comparative study in different versions by sowing in 4 versions, different sowing norms. For each version, analyze valuable farm traits during the vegetation, especially blue mass yield and hay yield. Just like that, studying to each version economical effectiveness and defining in saline areas an effective version of the sowing Melilotus albus.

The experiments were conducted on the farm “Navbakhorlik Doniyor Garden” in Syrdarya region, Boyovut district, Navbahor territory. Syrdarya region, Boyovut district, where the field experiments were conducted, is located in the east of region, bordered by Bekabad district of Tashkent region in the east, Khavas district in the southwest, Guliastan district in the north, Mirzaabat district in the west and the Republic of Tajikistan in the south. The climate of the experimental plot has abundant heat and light. The average temperature in July is 27-300 C, in January -2 ° C, - 4 ° C. The average annual rainfall is 200-300 mm. The effect of Bekabad wind is strong, sometimes when the wind blows hard, the plants can lie down. Groundwater is salty. The average duration of the frosty period is 217-240 days. The relative humidity of the air fluctuates in the range of 39-70% throughout the year; it sometimes drops below 30% during hot days.

The soil cover of the area, which conducted research is a typical gray soil that has been irrigated since ancient times and has a weak agro-irrigation horizon. According to the mechanical composition soil is dusty, heavy and sandy. The soil of the experimental field isn’t rich in organic matter. The amount of
humus in the topsoil is 0.4-0.6%, and in the bottom layer – 0.10-0.22%. They were found to contain very low amount total nitrogen, average amounts of phosphorus, and high amounts of potassium. In the top seed layer, the amount of nitrogen was 0.57 – 0.76, the amount of phosphorus was 2.48 – 4.2 and the the amount of potassium was 20.34 – 24.01 mg. The experiments were carried out on the basis of GOST 19453-80 – “Standard of elite seeds” requirements “for the method of preparation of alfalfa seeds” in 4 repetitions of 10 versions, one repetition of Melilotus albus in different sowing rates.

3. Results and Discussion

Studying of sowing norms is one of the important tasks in obtaining high yields from agricultural crops. To determine the sowing rate in Melilotus albus’s Kibray variety we conducted experiments (12 kg, 14 kg, 16 kg, 18 kg, 20 kg, 22 kg, 24 kg, 26 kg, 28 kg) in 4 repetitions in 10 different versions. In order to compare Melilotus albus’s Kibray variety and Tashkent –1 variety of ordinary alfalfa were sowed in 10 different versions according to the above norms. Sowing of both plants and varieties were carried out on March 22, 2019. Also, phenological observations of Melilotus albus’s Kibray variety and Tashkent–1 variety of alfalfa were carried out during the experiments. The results of our phenological observations were as follows (Table 1).

Table 1. Phenological observations Melilotus albus’s Kibray variety and Tashkent –1 variety of alfalfa

| Varieties       | Sowing | Sprouting | Leaf growth | Budding | Flowering | Mature |
|-----------------|--------|-----------|-------------|---------|-----------|--------|
| Kibray          | 22.03  | 01.04     | 09.04       | 26.05   | 05.06     | 26.06  |
| Tashkent-1      | 22.03  | 31.03     | 08.04       | 20.05   | 31.05     | 18.06  |

In our experiments, the following results were obtained when we studied the yielding of blue mass 1st haymaking of Melilotus albus’s Kibray variety and Tashkent -1 variety of alfalfa in 10 versions planted in different norms. Melilotus albus’s Kibray variety 12 kg seeds were sown per hectare in the 1st version 316 ts/ha, 14 kg seeds were sown in the 2nd version 320 ts/ha, 16 kg seeds were sown in the 3rd version 325 ts/ha, 18 kg seeds were sown in the 4th version 330 ts/ha, 20 kg seeds sown in the 5th version 335 ts/ha, 22 kg seeds were sown in the 6th 341 ts/ha, 24 kg seeds were sown in the 7th version 347 ts/ha, 26 kg seeds were sown in the 8th version 355 ts/ha, 28 kg seeds were sown in the 9th version 375 ts/ha and 30 kg seeds were sown in the 10th version 380 ts/ha. As the sowing rate increased according to the versions, blue mass yield increased significantly in the 9th version at the norm of 28 kg/ha and didn’t significantly increase in the 9th version in 30 kg/ha. For this reason, we found the blue mass yield was 28 kg/ha preferred version (Table 2).

Table 2. According to 1st haymaking blue mass yielding of Melilotus albus’s Kibray variety and Tashkent –1 variety of alfalfa

| Varieties       | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Kibray          | 316 | 320 | 325 | 330 | 335 | 341 | 347 | 355 | 375 | 380  |
| Tashkent-1      | 175 | 184 | 192 | 198 | 202 | 205 | 209 | 215 | 221 | 225  |

When we studied the yield of alfalfa Tashkent –1 variety on the 1st haymaking of blue mass, the following results were obtained. 12 kg seeds were sown in the 1st version 175 ts/ha, 14 kg seeds were sown in the 2nd version 184 ts/ha, 16 kg seeds were sown in the 3rd version 192 ts/ha, 18 kg seeds were sown in the 4th version 198 ts/ha, 20 kg seeds sown in the 5th version 202 ts/ha, 22 kg seeds were sown in the 6th 205 ts/ha, 24 kg seeds were sown in the 7th version 209 ts/ha, 26 kg seeds were sown in the 8th version 215 ts/ha, 28 kg seeds were sown in the 9th version 375 ts/ha and 30 kg seeds were sown in the 10th version 225 ts/ha. As the sowing rate increased according to the versions, the yield of blue mass increased and the average yield was 202 ts/ha (Table 2).
Table 3. An economical productivity of Melilotus albus’s Kibray variety than alfalfa

| Indexes                                                                 | Control | 12 kg/ha | 14 kg/ha | 16 kg/ha | 18 kg/ha | 20 kg/ha | 22 kg/ha | 24 kg/ha | 26 kg/ha | 28 kg/ha | 30 kg/ha |
|------------------------------------------------------------------------|---------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Productivity, ts/ha                                                   | 202     | 316      | 320      | 325      | 330      | 335      | 341      | 347      | 355      | 375      | 380      |
| Additional yield than the control, ts/ha                               | -       | 114      | 118      | 123      | 128      | 133      | 139      | 145      | 153      | 173      | 178      |
| Additional yield than the control, ts/ha                               | -       | 156.4    | 158.4    | 160.9    | 163.4    | 165.8    | 107.9    | 171.8    | 175.7    | 185.6    | 188.1    |
| 1 tsmass price, thousand sum                                           | 50      | 50       | 50       | 50       | 50       | 50       | 50       | 50       | 50       | 50       | 50       |
| Obtained income from 1kg blue mass yield, sum                         | 10100   | 15800    | 16000    | 16250    | 16500    | 16750    | 17050    | 17350    | 17750    | 18750    | 19000    |
| Obtained income from additional yiled, sum                            | -       | 5700     | 5900     | 6150     | 6400     | 6650     | 6950     | 7250     | 7650     | 8650     | 8900     |
| Expenses of crop production, sum/ha                                   | 3000    | 3000     | 3000     | 3000     | 3000     | 3000     | 3000     | 3000     | 3000     | 3000     | 3000     |
| The price of Melilotus albus seeds thousand sum                       | 810     | 480      | 560      | 640      | 720      | 800      | 880      | 960      | 1020     | 1100     | 1180     |
| Total expenses, sum                                                    | 3810    | 3480     | 3560     | 3640     | 3720     | 3800     | 3880     | 3960     | 4020     | 4100     | 4180     |
| income, sum/ha                                                        | 6290    | 12320    | 12440    | 12610    | 12780    | 12950    | 13170    | 13390    | 13730    | 14650    | 14820    |
| Additional income than control, thousand sum/ha                       | 0       | 6030     | 6150     | 6320     | 6490     | 6660     | 6880     | 7100     | 7440     | 8360     | 8530     |

Figure 1. Comparison Melilotus albus with alfalfa. Tashkent -1 variety on the left, Kibray variety on the right (second year, 29.04.2020)
When we studied economic efficiency alfalfa, which sowed as a control of *Melilotus albus*’s Kibray variety compared to the average yield of blue mass Tashkent – 1 variety (Figure 1), it significantly increased to 28 kg/ha in the 9th version 30 kg/ha. It didn’t increase in the 10th version. The additional income in the 9th version was 8360 thousand sum/ha (Table 3).

In the 1st haymaking of blue mass yielding *Melilotus albus*’s Kibray variety and Tashkent-1 variety of alfalfa and the seeds of the same weight were sown in 10 different sowing norms in 10 version in 4 repetitions. In comparison *Melilotus albus*’s Kibray variety showed its superiority in all versions. Also, in the 9th version, the difference was 154 ts/ha in the *Melilotus albus*’s Kibray variety. In *Melilotus albus*’s Kibray variety 375 ts/ha and Tashkent – 1 variety of alfalfa 221 ts/ha. From *Melilotus albus* Kibray’s variety was obtained more blue mass yield than Tashkent – 1 variety of alfalfa (Figure 2).

![According to 1st haymaking bluemass yielding of Melilotus albus Kibray variety and Tashkent – 1 variety of alfalfa ts/ha](image)

**Figure 2.** According to 1st haymaking blue mass yielding of *Melilotus albus*’s Kibray variety and Tashkent – 1 variety of alfalfa, ts/ha

*Haymaking 2:* When we studied the yield of blue mass in the 2nd haymaking, as the sowing rate increased in the versions, the yield of blue mass increased and 28 kg/ha in the 9th version significantly increase to 276 ts/ha. 30kg/ha in the 10th version didn’t significantly increase than 9 version. For this reason, according to obtained results in 2nd haymaking, we also found that the blue mass yield was 28 kg / hectare in the 9th version, it’s very preferred version (Table 4).

| Versions | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Sowing norm, kg/ha | | | | | | | | | | |
| Kibray   | 226 | 232 | 237 | 241 | 247 | 250 | 254 | 258 | 278 | 281 |
| Tashkent-1 | 178 | 182 | 187 | 190 | 193 | 195 | 198 | 202 | 206 | 209 |

When we study the blue mass yield common alfalfa of Tashkent – 1 variety in the 2nd haymaking, the blue mass yield increased and the average yield was 193 ts/ha (Table 4 and Figure 3).
nd days sown in the total blue mass in two haymaking the annual yield. I
th three haymaking was 577 ts/ha.

Comparison Melilotus albus’s Kibray variety and Tashkent – 1 variety of alfalfa on the 2nd haymaking: When comparing the blue mass yield in Melilotus albus’s Kibray variety and Tashkent – 1 of alfalfa in the 2nd haymaking 28 kg seeds per hectare were sown. In the 9th version Melilotus albus’s Kibray variety 278 ts/ha and Tashkent – 1 of alfalfa 206 ts/ha. Melilotus albus’s Kibray variety 72 ts/ha more blue mass yield than Tashkent – 1 of alfalfa (see Figure 2).

Haymaking 3: In terms of blue mass yield Melilotus albus’s Kibray variety wasn’t ready for the 3rd yield and was left 2 yield. According to the total blue mass in two haymaking the annual yield Melilotus albus’s Kibray variety was 603 ts/ha. In the 3rd haymaking blue mass yield of Tashkent – 1 variety of alfalfa was 182 ts/ha, and the total annual yield of three haymaking was 577 ts/ha. The annual blue mass of Melilotus albus’s Kibray variety was 603 ts/ha, and Tashkent – 1 variety of alfalfa was 576 ts/ha. The yield Melilotus albus’s Kibray variety was 26 ts/ha higher than Tashkent-1 variety of alfalfa.

Studying hay yield results. The 1st haymaking: In our experiments, when we studied the hay yield in the 1st haymaking Melilotus albus’s Kibray variety and Tashkent – 1 variety of alfalfa sown in the field in different 10 versions the following results were obtained. 12 kg seeds sown per hectare Melilotus albus’s Kibray variety in the 1st version 88.48 ts/ha, 14 kg seeds sown in the 2nd version 89.6 ts/ha, 16 kg seeds sown in the 3rd version 91.0 ts/ha, 18 kg seed sown in the 4th version 92.4 ts/ha, 20 kg seeds sown in the 5th version 93.8 ts/ha, 22 kg seeds sown in the 6th version 95.48 ts/ha, 24 kg seeds sown in the 7th version 97.16 ts/ha, 26 kg seeds sown in the 8th the version 99.4 ts/ha, 28 kg seeds sown in the 9th version 105.0 ts/ha and 30 kg seed sown in the 10th version 106.4 ts/ha. As the sowing rate increased according to the versions, in result the yield of hay increased. Hay yield increased significantly in the 9th version in norm 28 kg/ha. 30 kg/ha didn’t significantly increase in the 10th version. For this reason, the results obtained on blue mass yield 28 kg/ha in the 9th version, we found it that the preferred version. Tashkent – 1 variety of alfalfa sown seeds in different norms the average yield was 56 ts/ha (Table 5).

Table 5. According to 1st haymaking blue mass yield of Melilotus albus’s Kibray variety and Tashkent – 1 variety of alfalfa

| Versions | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Sowing norm, kg/ha | 12  | 14  | 16  | 18  | 20  | 22  | 24  | 26  | 28  | 30  |
| Kibray   | 88.5| 89.6| 91  | 92.4| 93.8| 95.8| 97.2| 99.4| 105 | 106.4|
| Tashkent-1| 49.0| 51.5| 53.8| 55.5| 56.6| 57.4| 58.5| 60.2| 61.9| 63.0|

Haymaking 2: When we studied the yield of hay in the 2nd haymaking Melilotus albus’s Kibray variety and Tashkent – 1 variety of alfalfa the following results were obtained. In Melilotus albus’s Kibray
variety 12 kg seeds sown per hectare in the 1st version 63.3 ts/ha, 14 kg seeds sown in the 2nd version 65.0 ts/ha. 16 kg seeds sown in the 3rd version 66.4 ts/ha, 18 kg seeds sown in the 4th version 67.5 ts/ha, 20 kg seeds sown in the 5th version 69.2 ts/ha, 22 kg seeds sown in the 6th version 70.0 ts/ha, 24 kg seeds sown in the 7th version 71.1 ts/ha, 28 kg seeds sown in the 8th version 72.2 ts/ha, 28 kg seeds sown in the 9th version 77.8 ts/ha, 30 kg seeds sown in the 10th version was 78.7 ts/ha. We can see in the 2nd haymaking the hay yield significantly increased in the 9th version 28 kg/ha. In the 2nd haymaking hay yield Tashkent-1 variety of alfalfa was 54.1 ts/ha (Table 6).

### Table 6 According to 2nd haymaking blue mass yield of Melilotus albus’s Kibray variety and Tashkent – 1 variety of alfalfa

| Versions  | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Sowing norm, kg/ha | 12  | 14  | 16  | 18  | 20  | 22  | 24  | 26  | 28  | 30  |
| Kibray    | 63.3| 65.0| 66.4| 67.5| 69.2| 70.0| 71.1| 72.2| 77.8| 78.7|
| Tashkent-1| 49.8| 51.0| 52.4| 53.2| 54.0| 54.6| 55.4| 56.6| 57.7| 58.5|

**Total yield:** The total annual hay yield Melilotus albus’s Kibray variety significantly increased in norm in the 9th version 28 kg/ha and it was 183 ts/ha. The average annual hay yield Tashkent-1 variety of alfalfa was 156 ts/ha (Table 7).

### Table 7. The average annual hay yield Tashkent-1 variety of alfalfa

| Versions  | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Sowing norm, kg/ha | 12  | 14  | 16  | 18  | 20  | 22  | 24  | 26  | 28  | 30  |
| Kibray    | 152 | 155 | 157 | 160 | 163 | 166 | 168 | 172 | 183 | 185 |
| Tashkent-1| 146 | 151 | 156 | 159 | 162 | 164 | 166 | 170 | 173 | 176 |

4. Conclusion

So, in conclusion, second and total yield of blue mass in the version with a sowing rate 28 kg per hectare, and the first, second and total yield of hay also different significantly from another version. For this reason, based on these results obtained, we found it necessary to sow 28 kg seeds per hectare in the saline areas according to the sowing norms Melilotus albus’s Kibray variety.

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