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# EFFECTS OF STOCKING DENSITY ON GROWTH AND DEVELOPMENT OF REPLACEMENT YOUNG DUCKS IN SEPARATE GROWING BY GENDER

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**Abstract**

An excessively high stocking density can affect the growth and development of ducks. The optimal stocking density should change with the age of ducks. The article presented the results of the experiment on the effect of stocking density on the growth, development and viability of replacement young ducks of the local population during separate growing at the Bishkul Poultry Farm LLP in Northern Kazakhstan in 2022. The study was carried out in ages the day of birth to 49 days in 3 stages with a transfer on day 22 and day 35, respectively. The stocking density of ducks before transfer in the first growing period, in the control group was 20 birds/m², in the first experimental group - 18 birds/m²; in the second experimental group - 16 birds/m²; and in the third experimental group - 14 birds/m², respectively. After transfer in the second growing period, the stocking density of the ducks in the control group was 10 birds/m², in the first experimental group - 9 birds/m²; in the second experimental group - 8 birds/m2; and in the third experimental group - 7 birds/m². In the third period, the stocking density in the control group was 7 birds/m², in the first experimental group - 6 birds/m²; in the second experimental group - 5 birds/m²; and in the third experimental group - 4 birds/m². In the study, increasing stocking density had a negative effect on the growth and development of ducks. It is noted that with an increase in stocking density in experimental groups bodyweight, absolute gain and average daily gain decreased, thus negatively affected these indicators.

**Key words:** duck; stocking density; separated rearing; growth and development; bodyweight; replacement young stock; cross.

**Introduction**

Due to the increased specialization, concentration and intensification of poultry farming, more and more importance is attached to the optimal combination of the main technological parameters, which are determined by the biological characteristics of the poultry being grown. Stocking density is one of the main technological factors and has a significant impact on poultry productivity and economic performance in general [1].

Along with a large amount of material on the study of the waterfowl performance, the effect of stocking density on the formation of meat performance of modern duck crosses with intensive rearing technology has not been studied enough at present. The use of existing standards does not always allow for obtaining high body weight gains [2,3].

Domestic and foreign scientists have found that during the period of adaptation to technological processes, the body of birds constantly experiences numerous effects of negative environmental factors, while often there is a decrease in the ability to withstand adverse effects, that is, a decrease in natural resistance is observed. The state of natural resistance is directly related to the activity of the hormonal and autonomic nervous systems and the activation of the body's defenses, otherwise, the process can lead to exhaustion of the body and loss of productivity. In conditions of intensive production, when a large number of technological factors act on the body of birds, it is necessary to strengthen and stimulate the resistance of the body of birds, mainly by providing adequate feeding and creating comfortable conditions for keeping [4,5].

High stocking densities can reduce performance as a result of several factors such as high ambient temperatures, insufficient air exchange, elevated ammonia levels, and poor access to feed and water [6,7]. The effect of high stocking densities on meat birds has been studied, resulting in negative effects such as reduced final body weight, feed intake and feed conversion, as well as bruising, poor feather quality and subsequent culling [8,9,10].

While a large number of studies have been conducted to evaluate the effect of stocking density on poultry meat production, information on stocking density for duck production is very limited. [11,12,13].

It has been established that a stocking density of more than 8 birds/m² has a negative effect on the growth rate of Peking ducks aged 21 to 42 days; in this regard, it was recommended to adjust the stocking density of Pekin duck males to 5–8 birds/m² [14]. The maximum stocking density for growing Peking ducks reared in paddocks on mesh floors is 8 birds/m² to achieve improved growth rates and carcass characteristics [6]. These results indicated that more birds/m² Peking ducks in the growing phase had a high stocking density. Male Peking ducks showed optimal body weight gain at a stocking density of 8 birds/m² until 4 weeks of age and at 4 birds/m² before slaughter at 10 weeks of age, regardless of the rearing method. In these studies, pectoralis and leg meat yields also decreased when stocking density was increased to 8 birds/m². Studies of the effect of stocking density (7, 9 and 11 birds /m²) on behavioral performance, reproductive capacity and carcass quality of Muscovy ducks have shown that stocking density of 9birds/m² gives the best results. [15,16,17].

**Materials and methods**

The experiment was carried out on replacement young ducks of the local population cross at the Bishkul Poultry Farm LLP in Northern Kazakhstan in 2022. For the experiment, one control group and 3 experimental groups of the “Bishkulsky” cross were formed with separate growing by gender in according to the method of analogues.

The stocking density of birds before transplantation (the first growing period) in the control group was 20 birds/m², in the first experimental group - 18 birds/m²; in the second experimental group - 16 birds/m²; and in the third experimental group - 14 birds/m², respectively. After transplantation (the second growing period), the stocking density of the birds in the control group was 10 birds/m², in the first experimental group - 9 birds/m²; in the second experimental group - 8 birds/m²; and in the third experimental group - 7 birds/m². In the third period, the stocking density in the control group was 7 birds /m², in the first experimental group - 6 birds /m²; in the second experimental group - 5 birds/m²; and in the third experimental group - 4 birds/m² (Table 1).

Table 1 - Research scheme

| Group | Growing period, days | | |
|---|---|---|---|
| | 1-21 | 22-35 | 36-49 |
| | Stocking density, birds/m² | | |
| Control | 20 | 10 | 7 |
| 1 experienced | 18 | 9 | 6 |
| 2 experienced | 16 | 8 | 5 |
| 3 experienced | 14 | 7 | 4 |

During the experiment period, weekly weighing of ducks was carried out with further determination of the average daily gain in bodyweight. During the experimental period, the birds were culled daily and the preservation of the livestock was recorded.

Ducklings were kept for 49 days on a deep litter. Indoors, the lighting was continuous and the temperature was maintained at 33°C from 1 to 3 days of age, then it was gradually reduced to about 25°C until 14 days of age, and then the temperature was maintained at about 16-22°C. Feeders and drinkers were installed in the room.

All ducklings had free access to water and food. The front of feeding and watering was 3 cm³/head. During the experimental period, the diets presented in Table 2 were used to feed the ducks.

Table 2 - The diet of replacement young animals during the study period

| The name of indicators | Compound feed Start for ducklings | | Compound feed Grow for ducklings | |
|---|---|---|---|---|
| | Content | | | |
| | g | % | g | % |
| Dry matter, g | 875,00 | 87,50 | 875,00 | 87,50 |
| Organic matter, g | 814,00 | - | 814,00 | - |
| Humidity, g | 125,00 | 12,50 | 125,00 | 12,50 |
| Raw ash, g | 61,00 | 6,10 | 61,00 | 6,10 |
| Crude protein, g | 202,00 | 20,20 | 219,00 | 21,90 |
| Digestible protein, g | 133,98 | 13,40 | 145,25 | 14,53 |
| Crude fat, g | 36,00 | 3,60 | 57,00 | 5,70 |
| Crude fiber, g | 37,00 | 3,70 | 46,00 | 4,60 |
| Nitrogen-free extractives, g | 539,00 | 53,90 | 492,00 | 49,20 |
| Starch | 38,00 | 34,10 | | |
| Nutritional value of feed: | | | | |
| Exchange energy, MJ | 13,99 | | 14,27 | |
| Metabolic energy, kcal | 3331,61 | | 3399,77 | |

When conducting research, the following indicators were taken into account: the safety of livestock; bodyweight of ducklings; absolute, relative, average daily gain in bodyweight. To determine the above indicators, the generally accepted methods developed at VNITIP [5] were used. All data obtained were subjected to biometric processing using the Microsoft office Excel computer program.

**Results**

Livestock preservation

The main indicator characterizing the viability of poultry in the conditions of industrial production of poultry products using intensive rearing technologies is the preservation of the livestock in the herd (Table 3).

Table 3 – The preservation of the livestock of replacement young animals for the period of experience, %

| Index | Groups | | | |
|---|---|---|---|---|
| | Control | Experienced | | |
| | | 1 | 2 | 3 |
| Preservation of young animals from daily to 21 days | 97,7 | 8,0 | 8,4 | 98,8 |
| Preservation of young animals from 21 to 49 days | 96,7 | 7,1 | 7,7 | 98,3 |

In the study, an increase in stocking density did not have a significant effect on the overall survival of ducks from one day old to 21 days of age; the survival rate was 98.8% in the 3rd experimental group, which is 1.1% higher than in the control group, this indicator is 98.3% in the 3rd experimental group, which is 1.6% higher than in the control group, respectively.

Meat productivity of replacement young birds

In the study, increasing stocking density had a negative effect on the growth and development of ducks. With an increase in stocking density: bodyweight, absolute gain and average daily gain decreased, respectively. The obtained data on growth and development are presented in the tables below (Table 4, 5).

Table 4 – Body weight of replacement young animals with separate maintenance by sex (♂)

| Age, days. | Control group | Experienced groups | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| 1 | 56,13±0,98 | 56,08±1,24 | 56,16±0,95 | 56,19±1,04 |
| 7 | 208,2±24,8 | 219,2±26,8 | 228,3±22,7 | 231,3±25,9 |
| 21 | 870,9±106,9 | 895,2±103,9 | 905,5±108,2 | 930,5±115,1 |
| 35 | 1735,4±220,2 | 1768,6±197,2 | 1823,5±210,8 | 1852,4±197,2 |
| 49 | 2794,7±260,7 | 2839,9±284,1 | 2883,2±290,8 | 2902,8±287,2 |

A high body weight during the entire period was observed in ducks of the 3rd experimental group, after transplantation in the second growing period, where the bodyweight of ducks exceeded by 2.68%, 3.79% and 6.41%, in the third period of the experiment, the ducks of this group had a bodyweight higher by 1 .56%, 4.52% and 6.31%, and at the end of the experiment the bodyweight of ducklings was 2902.8 g, which is 0.67%, 2.17% and 3.72%.more than in other groups at the end of the period.

Table 5 – Body weight of replacement young animals with separate maintenance by sex (♀)

| Age, days. | Control group | Experienced groups | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| 1 | 55,05±0,92 | 55,12±1,13 | 55,07±1,17 | 55,01±0,98 |
| 7 | 207,01±21,7 | 218,8±16,6 | 227,2±25,2 | 230,9±22,3 |
| 21 | 847,9±105,9 | 863,8±108,8 | 886,9±114,2 | 893,5±132,1 |
| 35 | 1690,3±214,3 | 1714,3±204,7 | 1735, 6±211,4 | 1765,1±206,1 |
| 49 | 2570,1±226,4 | 2614,7±222,3 | 2655,2±212,0 | 2713,8±183,6 |

A high body weight during the entire growing period was observed in ducks of the 3rd experimental group, after transplantation in the second growing period, where the bodyweight of ducks exceeded by 0.74%, 3.32% and 5.1 in the third period of the experiment, the ducks of this group were observed the bodyweight is higher by 1.67%, 2.87% and 4.24% and at the end of the experiment the bodyweight of ducklings was 2713 g, which is 2.16%, 3.65% and 5.3% more than in the rest of the group , respectively.

In the course of research, when determining the average daily increase, the corresponding dynamics was observed, where higher rates were noted in the 2nd and 3rd experimental groups than in the control group (tables 6, 7).

Table 6 – Average daily body weight gain (♂)

| Age, days | Control group | Experienced groups | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| 1-7 | 21,72 | 23,30 | 24,59 | 25,01 |
| 7-21 | 47,33 | 48,28 | 48,37 | 49,94 |
| 21-35 | 61,75 | 62,38 | 65,57 | 65,85 |
| 35-49 | 75,66 | 76,52 | 77,69 | 78,02 |

Accordingly, high average daily gains in body weight were noted in ducks in the 2nd and 3rd experimental groups than in the control group. So, the average daily gain in bodyweight in the period from 7 to 21 days. exceeded the control group by 5.22% and by 3.32% in the 1st experimental group than in the birds of the 3rd experimental group, from 21 to 35 days. the difference in growth was 6.22% with the control group and 5.26% with the first experimental group, from 35 days. on the 49th day, the increase in bodyweight in the experimental group 3 was higher by 3.02% and 1.92% in the control and first experimental groups.

Table 7– Average daily body weight gain (♀)

| Age, days | Control group | Experienced groups | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| 1-7 | 21,70 | 23,38 | 24,58 | 25,12 |
| 7-21 | 45,77 | 46,07 | 47,12 | 47,33 |
| 21-35 | 60,17 | 60,55 | 60,62 | 62,26 |
| 35-49 | 63,84 | 64,31 | 65,68 | 67,76 |

Accordingly, high average daily gains in body weight were noted in ducks in the 2nd and 3rd experimental groups. So, the average daily gain in bodyweight in the period from 7 to 21 days. exceeded the control group by 3.29% and by 2.66% in the 1st experimental group than in the birds of the 3rd experimental group, from 21 to 35 days. The difference in growth was 3.35% with the control group and 2.74% with the first experimental group, from 35 days. for 49 days. The increase in bodyweight in the experimental group 3 exceeded by 5.78% and 5.09% the control and the first experimental groups.

**Discussion**

This study showed that body weight and weight gain of ducks decreased with increasing stocking density. These results were confirmed by the data of other researchers on ducks [18]. Ducks reared at a stocking density of 4 birds/m² at 36 to 49 days of age have higher bodyweight and body weight gains than those reared at a stocking density of 7 birds/m2 at 36 to 49 days of age [14]. Which confirms our findings. In other authors, on the contrary, planting density did not affect the final bodyweight [19,20].

In our study, a high stocking density negatively affects the growth performance of ducks, with a stocking density of 10 birds/m2at the age of 21 to 35 days, 7 birds/m² at the age of 36-49 days, respectively. Similar results were obtained by other authors who recommended increasing the stocking density of ducks to 8–7 birds/m² at the

age of 21 to 35 days, 4–6 birds/m² at the age of 36 to 49 days, respectively [13,19,21].

With a high stocking density, bodyweight and bodyweight gain decrease, which can be associated with many factors: 1. a decrease in the area for each bird leads to high-temperature stress of the bird 2. Insufficient air exchange 3. Increased ammonia content in the room, 4. Decreased taste qualities of food and drinking water [11,22].

In our study, the final bodyweight of replacement young animals at 7 weeks of age ranged from 2682.4 to 2828.3. Similar results for the final body weight of ducks were obtained by other authors [3,4,6]. According to the chemical composition, the diet of all groups was identical throughout the experiment, therefore, in our study, differences in absolute gain, final bodyweight may indicate the effect of stocking density on these criteria. In our study, the highest daily gains are observed in ducklings aged 7 to 35 days, other authors note the highest daily gains in ducks aged 28 to 42 days [11,21].

**Conclusions**

High rates of body weight of ducklings were observed at a stocking density of 14 birds/m² in the first period, 7 birds/m² in the second period and 4 birds/m² in the third period. The body weight of ducklings at 49 days of age was 2902.8 for drakes and 2713.8 for ducks. Average daily was also higher in the stocking density group. It can be concluded that a high stocking density negatively affects the bodyweight and average daily gains of replacement young animals aged from birth to 49 days. The use of rational stocking density allows to achieve the best body weight and average daily gains. Hence, the optimal stocking density will be 14-16 birds/m² from birth to 21 days of age, from 22 to 35 days this figure will be 7-8 birds/m² and from 36 to 49 days 4-5 birds/m², respectively.

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# ВЛИЯНИЕ ПЛОТНОСТИ ПОСАДКИ НА РОСТ И РАЗВИТИЕ УТОК РЕМОНТНОГО МОЛОДНЯКА ПРИ РАЗДЕЛЬНОМ ВЫРАЩИВАНИИ ПО ПОЛУ

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**Аннотация**

Чрезмерно высокая плотность посадки отрицательно сказывается на росте и развитии уток. Оптимальная плотность посадки должна меняться с возрастом уток. В данной статье изложены результаты исследований по влиянию плотности посадки на рост, развитие и жизнеспособность ремонтного молодняка уток местной популяции при раздельном выращивании по полу в ТОО «Бишкульская птицефабрика» в условиях Северного Казахстана в 2022 году. Исследования проводились на утках в возрасте с суточного по 49 сутки в 3 этапа с пересадкой на 22 и 35 сутки соответственно. Плотность посадки уток до пересадки в первый период выращивания, в контрольной группе составила 20 гол/м², в первой опытной группе - 18 гол/м²; во второй опытной группе - 16 гол/ м²; и в третьей опытной группе - 14 гол/м² соответственно. После пересадки во второй период выращивания плотность посадки уток, в контрольной группе составила 10 гол/м², в первой опытной группе - 9 гол/м²; во второй опытной группе - 8 гол/м²; и в третьей опытной группе - 7 гол/м². В третий период выращивания плотность посадки в контрольной группе составила 7 гол/м², в первой опытной группе - 6 гол/м²; во второй опытной группе - 5 гол/м²; и в третьей опытной группе - 4 гол/м2. По результатам исследований увеличение плотности посадки отрицательно сказалось на росте и развитии уток. Отмечается, что при увеличении плотности посадки в опытных группах живая масса, абсолютный и среднесуточный приросты снижались, и тем самым негативно влияли на данные показатели.

**Ключевые слова:** утка; плотность посадки; раздельное выращивании; рост и развитие; масса тела; ремонтный молодняк; кросс.

# ЖЫНЫСЫ БОЙЫНША БӨЛЕК ӨСІРУ КЕЗІНДЕ ТАБЫН ТОЛЫҚТЫРУШЫ ҮЙРЕК БАЛАПАНДАРЫНЫҢ ӨСУІ МЕН ДАМУЫНА ОТЫРҒЫЗУ ТЫҒЫЗДЫҒЫНЫҢ ӘСЕРІ

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**Түйін**

Тым жоғары отырғызу тығыздығы үйректердің өсуі мен дамуына теріс әсер етеді. Оңтайлы отырғызу тығыздығы үйректердің жасына байланысты өзгеруі керек. Бұл мақалада 2022 жылы Солтүстік Қазақстан жағдайында «Бескөл құс фабрикасы» ЖШС-де жынысы бойынша бөлек өсіру кезінде жергілікті популяцияның табын толықтырушы үйрек балапандарының өсуі мен дамуына және өміршеңдігіне отырғызу тығыздығының әсері бойынша ғылыми зерттеу нәтижелері баяндалған. Зерттеулер сәйкесінше 22 және 35 тәуліктік табын толықтырушы үйректермен тәуліктік жасынан 49 тәулікке дейінгі жас үйректерді 3 кезеңде алмастыру бойынша жүргізілді. Өсірудің бірінші кезеңінде бақылау тобында үйректерді алмастыруға дейін отырғызу тығыздығы 20 бас/м², бірінші тәжірибелік топта - 18 бас/м²; екінші тәжірибелік топта - 16 бас/ м²; және үшінші тәжірибелік топта - тиісінше 14 бас/м² құрады. Өсірудің екінші кезеңінде үйректерді алмастырғаннан кейін отырғызу тығыздығы бақылау тобында 10 бас/м², бірінші тәжірибелік топта - 9 бас/м²; екінші тәжірибелік топта - 8 бас/м²; және үшінші тәжірибелік топта - 7 бас/м² құрады. Үшінші кезеңде отырғызу тығыздығы бақылау тобында 7 бас/м², бірінші тәжірибелік топта - 6 бас/м²; екінші тәжірибелік топта - 5 бас/м²; және үшінші тәжірибелік топта - 4 бас/м² құрады. Зерттеу нәтижелері бойынша отырғызу тығыздығының жоғарылауы үйректердің өсуі мен дамуына теріс әсер етті. Тәжірибелік топтарда отырғызу тығыздығының жоғарылауымен тірілей салмақ, абсолюттік және орташа тәуліктік өсімдер төмендеді, осылайша бұл көрсеткіштерге теріс әсерін тигізді.

**Кілт сөздер:** үйрек; отырғызу тығыздығы; бөлек өсіру; өсуі мен дамуы; дене салмағы; табын толықтырушы балапан; кросс.