

# THE EFFECT OF GROWING PEANUT VARIETIES AS A REPEAT CROP ON SOIL BULK DENSITY AND ITS POROSITY

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## Abstract

This article presents data on the bulk density of the experimental field soil and its porosity under furrow and drip irrigation regimes, for the Lider and Salomat peanut varieties sown as a repeat crop in the soils of Denov district, Surkhandarya region.

**Keywords:** Surkhandarya region, Denov district, furrow and drip irrigation, irrigation methods, irrigation regimes, peanut varieties, Lider, Salomat, bulk density, porosity.

## Introduction

Today, the area under peanut cultivation in the world is 26.4 million hectares, with a total yield of 37.1 million tons and an average yield of 1.4 tons per hectare. Of world peanut production, 37% comes from China, 25% from African countries, 21% from the USA, and 6% from Oceania countries. Peanut seeds contain 20-36% protein and 40-57% non-drying oil. Its oil is used in the food industry to produce canned foods and confectionery, as well as high-quality margarine and various sweets. Halva, candy, cakes and other confectionery products are made from peanut kernels, and they are also eaten roasted. Its fruit is a pod, and the pods contain 1-2, 2-3 or 4-7 seeds. The weight of 1000 pods ranges from 500 g to 1900 g. The weight of 1000 seeds ranges from 200 g to 1200 g. In the soil where peanuts are grown, 50 kg of pure nitrogen accumulates per season through the nodule bacteria on its roots [2, pp. 5-7]. According to the research results of M. E. Amanova, A. Rustamov and T. Duysenov [3, p. 24], when growing peanut seeds using class



1 seeds, the optimal sowing scheme for seed production of the "Salomat" variety is 70x15 cm (95-100 thousand plants), while for the "Qibray-4" and "Mumtoz" varieties, because their seeds are larger, the optimal sowing scheme is 70x20-1, that is, good results were achieved when an average of 75-80 thousand plants per hectare were left. For the "Salomat" variety (with an average weight of 1000 seeds of 500-600 g), a sowing rate of 50-55 kg/ha is recommended, and for the "Qibray-4" and "Mumtoz" varieties (with an average weight of 1000 seeds of 750-800 g), a sowing rate of 60-65 kg/ha is recommended.

Scientific research has been conducted on sandy and typical grey soils in the southern regions of our country, sowing the peanut varieties "Qibray-4", "Salomat", "Mumtoz" and "Toshkent 112" using the 70x10, 70x15, 70x20 and 90x15/2 schemes. According to the results of the experiment conducted, for commercial production on typical grey soils, a density of 150 thousand plants per hectare and a sowing rate of 70-85 kg/ha are recommended for the "Toshkent 112" and "Salomat" varieties (70x10 cm), while a density of 100-110 thousand plants per hectare and a seed sowing rate of 80-95 kg/ha are recommended for the "Mumtoz" and "Qibray-4" varieties (70x15 cm) [4, p. 16].

### Research methods

During the research, the agrophysical and agrochemical properties of the soil and phenological observations of the plants in the field experiments were obtained using the manuals "Methods of Conducting Field Experiments" of the Uzbek Cotton Research Institute (UzPITI) and "Methods of Agrophysical, Agrochemical and Microbiological Studies in Irrigated Cotton-Growing Regions", and the variation-statistical analysis of the data obtained was carried out on the basis of B.A.Dospekhov's method "Methodology of Field Experiment".

### Research Results

Data on the bulk density of the soil and its porosity for the years the experiment was conducted were determined under field conditions. In the experiment, on the common background, before irrigation the bulk density of the soil in the 0-30 cm layer was 1.31 g/cm<sup>3</sup> and its corresponding porosity was 51.5%; in the 0-50 cm layer of the soil the bulk density was 1.36 g/cm<sup>3</sup> and its porosity was 49.6%; and in the 0-70 cm layer the corresponding figures were 1.38 g/cm<sup>3</sup> and 48.9%.

By the end of the growing season, in the control variant of the experiment, when irrigation was carried out at a pre-irrigation soil moisture of 70-70-60%, the bulk density in the 0-30 cm estimated arable layer of the soil was found to be 1.36 g/cm<sup>3</sup> and its porosity was 49.3%. In the 0-50 cm estimated arable layer of the soil, the bulk density was 1.39 g/cm<sup>3</sup> and its porosity 48.8%, and in the 0-70 cm estimated layer the bulk density and porosity were 1.40 g/cm<sup>3</sup> and 48.1% respectively. In the furrow-irrigated variant of the experiment with a pre-irrigation soil moisture regime of 70-75-65%, the bulk density of the soil in the 0-30, 0-50 and 0-70 cm estimated layers was found to be 1.38, 1.40 and 1.41 g/cm<sup>3</sup> respectively, and the porosity figures were 48.9%, 48.0% and 47.7% respectively. When irrigation was carried out at a pre-irrigation soil moisture regime of 60-75-60% of field capacity (FC), the bulk density of the soil in the 0-30 cm layer was 1.33 g/cm<sup>3</sup>, in the 0-50 cm estimated layer 1.36 g/cm<sup>3</sup>, and in the 0-70 cm estimated layer 1.38 g/cm<sup>3</sup>, with the corresponding porosity values of 50.5%, 49.4% and 48.7%.



In the drip-irrigated variants of the experiment, at a pre-irrigation soil moisture regime of 70-70-60%, the bulk density was 1.36 g/cm<sup>3</sup> in the 0-30 cm estimated layer, 1.38 g/cm<sup>3</sup> in the 0-50 cm estimated layer, and 1.40 g/cm<sup>3</sup> in the 0-70 cm estimated layer, with porosity values of 49.6%, 48.6% and 48.1% respectively (see Table 1).

**Table 1 Soil bulk density (g/cm<sup>3</sup>) and porosity (%) (2024)**

| Soil layer,<br>cm | At the beginning<br>of the season |      | At the end of the season            |      |          |      |          |      |                 |      |          |      |          |      |
|-------------------|-----------------------------------|------|-------------------------------------|------|----------|------|----------|------|-----------------|------|----------|------|----------|------|
|                   |                                   |      | Furrow irrigation                   |      |          |      |          |      | Drip irrigation |      |          |      |          |      |
|                   |                                   |      | Irrigation regime relative to FC, % |      |          |      |          |      |                 |      |          |      |          |      |
|                   |                                   |      | 70-70-60                            |      | 70-75-65 |      | 60-75-60 |      | 70-70-60        |      | 70-75-65 |      | 60-75-60 |      |
|                   | g/cm³                             | %    | g/cm³                               | %    | g/cm³    | %    | g/cm³    | %    | g/cm³           | %    | g/cm³    | %    | g/cm³    | %    |
| 0-10              | 1.28                              | 52.6 | 1.34                                | 50.4 | 1.34     | 50.4 | 1.34     | 50.3 | 1.35            | 50.0 | 1.34     | 50.3 | 1.35     | 50.0 |
| 10-20             | 1.32                              | 51.1 | 1.39                                | 49.6 | 1.37     | 49.3 | 1.36     | 48.5 | 1.38            | 48.9 | 1.38     | 48.9 | 1.38     | 48.9 |
| 20-30             | 1.37                              | 49.3 | 1.40                                | 48.1 | 1.40     | 48.1 | 1.40     | 48.1 | 1.41            | 47.8 | 1.42     | 47.4 | 1.41     | 47.8 |
| 30-40             | 1.40                              | 48.1 | 1.43                                | 47.0 | 1.42     | 47.4 | 1.43     | 47.0 | 1.43            | 47.0 | 1.40     | 48.1 | 1.43     | 47.0 |
| 40-50             | 1.42                              | 47.4 | 1.41                                | 47.4 | 1.44     | 46.7 | 1.42     | 47.8 | 1.44            | 46.7 | 1.44     | 46.7 | 1.45     | 46.3 |
| 50-60             | 1.41                              | 47.8 | 1.42                                | 47.4 | 1.41     | 47.8 | 1.42     | 47.4 | 1.45            | 46.3 | 1.42     | 47.4 | 1.40     | 48.1 |
| 60-70             | 1.43                              | 47.0 | 1.40                                | 46.7 | 1.43     | 47.0 | 1.44     | 48.1 | 1.41            | 47.8 | 1.43     | 47.0 | 1.42     | 47.4 |
| 70-80             | 1.44                              | 46.7 | 1.42                                | 47.8 | 1.45     | 46.3 | 1.41     | 47.4 | 1.43            | 47.0 | 1.44     | 46.7 | 1.43     | 47.0 |
| 80-90             | 1.42                              | 47.4 | 1.43                                | 46.3 | 1.41     | 47.8 | 1.45     | 47.0 | 1.41            | 47.8 | 1.42     | 47.4 | 1.41     | 47.8 |
| 90-100            | 1.41                              | 47.8 | 1.41                                | 47.0 | 1.42     | 47.4 | 1.43     | 47.8 | 1.42            | 47.4 | 1.40     | 48.1 | 1.40     | 48.1 |
| 0-30<br>(average) | 1.32                              | 51.0 | 1.38                                | 49.4 | 1.37     | 49.3 | 1.37     | 49.0 | 1.38            | 48.9 | 1.38     | 48.9 | 1.38     | 48.9 |
| 0-50<br>(average) | 1.36                              | 49.7 | 1.39                                | 48.5 | 1.39     | 48.4 | 1.39     | 48.3 | 1.40            | 48.1 | 1.40     | 48.3 | 1.40     | 48.0 |
| 0-70<br>(average) | 1.38                              | 49.0 | 1.40                                | 48.1 | 1.40     | 48.1 | 1.40     | 48.2 | 1.41            | 47.8 | 1.40     | 48.0 | 1.41     | 47.9 |

Under drip irrigation, at a pre-irrigation soil moisture regime of 70-75-65% of FC, the bulk density and porosity of the soil in the 0-30, 0-50 and 0-70 cm estimated layers were 1.35, 1.38 and 1.38 g/cm<sup>3</sup>, and the porosity in the layers mentioned above was 50.0%, 48.8% and 48.6%. When the experiment was carried out at a pre-irrigation soil moisture regime of 60-75-60%, the bulk density was 1.34 g/cm<sup>3</sup> in the 0-30 cm soil layer, and 1.37 and 1.38 g/cm<sup>3</sup> in the 0-50 and 0-70 cm estimated layers, with the porosity in the layers mentioned above recorded as 50.4%, 49.1% and 48.6%. According to the data obtained from the field experiments in 2025, at the beginning of the growing season, on the common background, the bulk density of the soil in the 0-30 cm layer was 1.31 g/cm<sup>3</sup> and its corresponding porosity was 52.0%; in the 0-50 cm layer this figure was 1.34 g/cm<sup>3</sup> with a porosity of 50.5%; and in the 0-70 cm estimated layer the bulk density was 1.38 g/cm<sup>3</sup>, with a porosity of 49.0%.

**Table 2 Soil bulk density (g/cm<sup>3</sup>) and porosity (%) (2025)**

| Soil layer,<br>cm         | At the beginning of the<br>season |      | At the end of the season            |      |          |      |          |      |                 |      |          |      |          |      |
|---------------------------|-----------------------------------|------|-------------------------------------|------|----------|------|----------|------|-----------------|------|----------|------|----------|------|
|                           |                                   |      | Furrow irrigation                   |      |          |      |          |      | Drip irrigation |      |          |      |          |      |
|                           |                                   |      | Irrigation regime relative to FC, % |      |          |      |          |      |                 |      |          |      |          |      |
|                           |                                   |      | 70-70-60                            |      | 70-75-65 |      | 60-75-60 |      | 70-70-60        |      | 70-75-65 |      | 60-75-60 |      |
|                           | g/cm³                             | %    | g/cm³                               | %    | g/cm³    | %    | g/cm³    | %    | g/cm³           | %    | g/cm³    | %    | g/cm³    | %    |
| 0-10                      | 1.28                              | 52.6 | 1.32                                | 51.1 | 1.30     | 51.8 | 1.35     | 50.0 | 1.34            | 50.4 | 1.34     | 50.4 | 1.33     | 50.7 |
| 10-20                     | 1.31                              | 51.5 | 1.38                                | 48.9 | 1.37     | 49.2 | 1.34     | 50.4 | 1.39            | 48.5 | 1.39     | 48.5 | 1.35     | 50.0 |
| 20-30                     | 1.33                              | 51.8 | 1.39                                | 48.5 | 1.42     | 47.4 | 1.39     | 48.5 | 1.42            | 47.4 | 1.41     | 47.8 | 1.34     | 50.3 |
| 30-40                     | 1.38                              | 48.9 | 1.42                                | 47.4 | 1.40     | 48.1 | 1.42     | 47.4 | 1.44            | 46.7 | 1.44     | 46.7 | 1.40     | 48.1 |
| 40-50                     | 1.41                              | 47.8 | 1.45                                | 46.3 | 1.44     | 46.7 | 1.45     | 46.3 | 1.41            | 47.8 | 1.43     | 47.0 | 1.44     | 46.7 |
| 50-60                     | 1.43                              | 47.0 | 1.44                                | 46.7 | 1.43     | 47.0 | 1.43     | 47.0 | 1.42            | 47.4 | 1.42     | 47.4 | 1.40     | 48.1 |
| 60-70                     | 1.42                              | 47.4 | 1.42                                | 47.4 | 1.41     | 47.8 | 1.42     | 47.4 | 1.43            | 47.0 | 1.44     | 46.7 | 1.43     | 47.0 |
| 70-80                     | 1.40                              | 48.1 | 1.40                                | 48.1 | 1.44     | 46.7 | 1.41     | 47.8 | 1.41            | 47.8 | 1.42     | 47.4 | 1.42     | 47.4 |
| 80-90                     | 1.42                              | 47.4 | 1.43                                | 47.0 | 1.42     | 47.4 | 1.43     | 47.0 | 1.40            | 48.1 | 1.45     | 46.3 | 1.44     | 46.7 |
| 90-100                    | 1.40                              | 48.1 | 1.42                                | 47.4 | 1.43     | 47.0 | 1.45     | 46.3 | 1.41            | 47.8 | 1.42     | 47.4 | 1.41     | 47.8 |
| <b>0-30<br/>(average)</b> | 1.31                              | 52.0 | 1.36                                | 49.5 | 1.37     | 49.5 | 1.36     | 49.6 | 1.39            | 48.8 | 1.38     | 48.9 | 1.34     | 50.3 |
| <b>0-50<br/>(average)</b> | 1.34                              | 50.5 | 1.39                                | 48.4 | 1.39     | 48.6 | 1.39     | 48.5 | 1.40            | 48.2 | 1.40     | 48.1 | 1.37     | 49.1 |
| <b>0-70<br/>(average)</b> | 1.37                              | 49.6 | 1.40                                | 48.0 | 1.40     | 48.3 | 1.40     | 48.1 | 1.41            | 47.9 | 1.41     | 47.8 | 1.38     | 48.8 |

By the end of the growing season, under furrow irrigation, in the control variant with a pre-irrigation soil moisture regime of 70-70-60% of FC, the bulk density in the 0-30 cm layer was 1.36 g/cm<sup>3</sup> with a porosity of 49.5%; in the 0-50 cm layer it was 1.39 g/cm<sup>3</sup> with a porosity of 48.4%; and in the 0-70 cm estimated layer the bulk density was 1.40 g/cm<sup>3</sup> with a porosity of 48%. In the experiment, with a pre-irrigation soil moisture regime of 70-75-65% of FC, the bulk density in the 0-30 cm arable layer of the soil was 1.37 g/cm<sup>3</sup> with a porosity of 49.5%, while the bulk density and porosity in the 0-50 cm layer were 1.39 g/cm<sup>3</sup> and 48.6% respectively. In the 0-70 cm layer of the soil, the bulk density was found to be 1.40 g/cm<sup>3</sup> and its porosity 48.3%. When irrigation was carried out at a pre-irrigation soil moisture regime of 60-75-60% of FC, the bulk density in the 0-30 cm estimated layer of the soil was 1.36 g/cm<sup>3</sup> with a porosity of 49.6%, and in the 0-50 and 0-70 cm estimated layers the bulk density was 1.39 and 1.40 g/cm<sup>3</sup>, with porosity figures of 48.5% and 48.1% respectively.

In the drip-irrigated experiment, with a pre-irrigation soil moisture regime of 70-70-60% of FC, the bulk density in the 0-30 cm estimated layer of the soil was 1.39 g/cm<sup>3</sup> with a porosity of 48.8%, and in the 0-50 and 0-70 cm estimated layers the bulk density was 1.40 and 1.41 g/cm<sup>3</sup>, with porosity of 48.2% and 47.9% respectively. When the irrigation agrotechnical measures were carried out at a pre-irrigation soil moisture regime of 70-75-65% of FC, the bulk density in the 0-30 cm and 0-50 cm estimated layers of the soil was 1.38 and 1.40 g/cm<sup>3</sup>, and its porosity was 48.9% and 48.1%. In the 0-70 cm estimated layer of the soil, the bulk density was 1.41 g/cm<sup>3</sup> and its porosity 47.8%. In the experiment, at a pre-irrigation soil moisture regime of 60-75-60% of FC,





the bulk density in the 0-30 cm estimated layer of the soil was 1.34 g/cm<sup>3</sup> with a porosity of 50.3%; in the 0-50 cm layer the bulk density was 1.37 g/cm<sup>3</sup> with a porosity of 50.3%; and in the 0-70 cm estimated layer the bulk density was 1.38 g/cm<sup>3</sup> with a porosity of 48.8%, as presented in detail in Table 2.

### Conclusion

In the soils of Denov district, Surkhandarya region, when growing the Lider and Salomat peanut varieties as a repeat crop, the soil's bulk density and porosity improved over the years under the drip irrigation regime with a pre-irrigation soil moisture of 60-75-60% of FC, compared with furrow irrigation at a pre-irrigation soil moisture of 70-70-60%.

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