

TOTAL PROTEIN CONTENT IN THE PLANT INDIGOFERA TINCTORIA LINN

Karabaev H.V.

Kokand State Pedagogical Institute, Doctoral Student of the Department of Chemistry

<https://doi.org/10.5281/zenodo.12594237>

Abstract. The article examines the study of the total protein content in the root, stem and grain of the plant *Indigofera tinctoria* L., a representative of the legume family (*Fabaceae*), grown in three different (fertile, saline, arid) climatic conditions of the Fergana region. The study used the Kjeldahl method, one of the generally accepted methods for determining the total protein content in the plant *Indigofera tinctoria* L. When determining the amount of protein in samples using the Kjeldahl method, the stages of hydrolysis with sulfuric acid, neutralization with sodium hydroxide and titration of the remaining acid with an alkali solution were carried out. The results obtained were compared with each other and with the amount of protein in other legumes. According to the results of the study, 25.967% protein was found in the grain of *Indigofera tinctoria* L. grown in arid conditions, 10.723% protein was found in the root under fertile conditions, and 5.688% protein was found in the stem under saline conditions.

Keywords: *indigofera tinctoria* L., total protein, Kjeldahl method, hydrolysis, neutralization, titration, root, stem, grain.

INTRODUCTION

The chemical composition of plants has been of interest to scientists around the world since ancient times, and continuous scientific research has been carried out for many years to study them, which continues to this day.

Plants belonging to the legume family (*Fabaceae*) are rich in their chemical composition in many complex compounds, such as proteins, oils, carbohydrates, vitamins, flavonoids, indigoids, macroelements and microelements.

The study and application of the chemical composition of plants of the genus *Indigofera* helps to solve many problems facing humanity. In particular, as a result of planting these plants in agriculture, the productivity of marginal, low-yield lands increases, the soil is enriched with nitrogen, the use of feed products in livestock raising increases the productivity of animals and, as a result, humanity is partially provided with food that meets its needs.

LITERATURE ANALYSIS AND METHODS

Many scientific studies have been conducted on representatives of the genus *Indigofera*. For example, Alagbe John (Sumitra Research Institute, Gujarat, India, 2020) examined the total protein content of *Indigofera tinctoria* in a study titled “Chemical assessment of protein, amino acid and vitamin content of root, stem and leaves of *Indigofera tinctoria*” and in As a result, the presence of protein was determined to be 30.53% in the leaf, 5.11% in the stem and 8.22% in the root [1].

Veena Sharma and Aastha Agarwal (India, 2015) in a research paper titled “Physicochemical and Antioxidant Analysis of Methanol and Hydromethanol Extracts of Aerial Parts of *Indigofera tinctoria* Linn” found that amino acids and proteins are present in methanol and hydromethanol extracts of *Indigofera tinctoria*. [2]

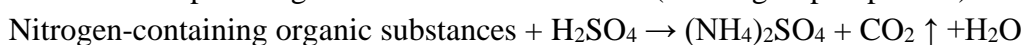
In the research work of M.K. Ghafar, A.U. Itodo, F.A. Atiku, A.M.Hasan and I.J.Peni (Nigeria, 2011) entitled “Total and Mineral Composition of Hairy *Indigo* Leaves (*Indigofera astragalina*)”, *Indigofera astragalina* leaves were found to contain 8.23% protein. [3]

During the research, we used the Keldahl method, one of the internationally widely used methods for determining the amount of total proteins in the *Indigofera tinctoria* plant.

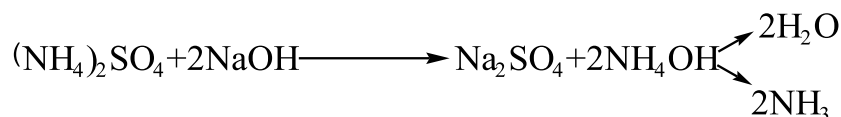
RESEARCH RESULTS AND DISCUSSION

The root, stem and grain of *Indigofera tinctoria* grown in local climatic conditions constitute the bulk of the total mass of the plant. Therefore, in our research we sought to study precisely these parts of the plant.

One of the methods for determining the amount of total protein is the Keldahl method. According to this, the amount of total protein is calculated by determining the amount of nitrogen. The essence of the method is the formation of ammonium sulfate salts by hydrolysis of organic substances in the sample using concentrated sulfuric acid (amino group in protein).



After hydrolysis was completed, sodium hydroxide was used to convert ammonium sulfate into ammonia.



The ammonia or ammonium hydroxide formed as a result of neutralization was ingested in a solution of sulfuric acid. The remaining acid is titrated with an alkali solution. The amount of nitrogen is calculated from the calculated amount of ammonia. An accurate sample for analysis is taken from an average ground homogeneous sample of the test sample into a test tube; the error should not exceed 0.1%. Quantitative analysis of the sample is carried out in a Keldahl flask. After this, the experiment is continued according to the instructions [4].

Processing of the results obtained: the mass fraction of nitrogen (X) in the analyzed sample is calculated using the formula as a percentage of the sample mass by volume after titrating the amount of ammonia passed through dilute sulfuric acid.

$$X = \frac{(V_1 - V_0) * K * 0.0014}{m} * 100\%$$

V_1 - volume of the initial 0.1 mol/l sodium hydroxide solution, ml.;

V_0 - volume of 0.1 mol/l sodium hydroxide solution used for titration of 0.1 mol/l sulfuric acid solution in the experimental sample, ml.;

m – weight of sample taken for analysis, gr.

Table 1

Based on the results of the analysis, it was found that the total protein content in the *Indigofera tinctoria* plant is as follows:

№	Organs of <i>Indigofera tinctoria</i>	Amount of total protein, %	(Alagbe John) India 2020 (%)
1	Root ¹	10,723	
2	Root ²	5,538	
3	Root ³	5,038	
4	Stem ¹	2,0125	5,11
5	Stem ²	5,688	

6	Stem ³	5,112	
7	Grain ¹	21,475	
8	Grain ²	22,002	
9	Grain ³	25,967	

Note for numbers 1, 2, 3 indicated in the table: the study was carried out at 3 sites,
 1st research site - the land plot of the farm "Abdurazzok - Mukhtarjon Yuksalish", located in the Katta-Karakol SGM, Uchkoprik district, Fergana region (fertile soil);

2-second research site – land plot of the “Dangara Multidisciplinary Technical College”, located in Bogish SGM, Dangara district, Fergana region (saline soil);

The third research site is a land plot of a recreation center under the management of the Kokan State Pedagogical Institute, located in the Sarykorgan SGM of the Uchkoprik district of the Fergana region (dry soil).



Figure 1. Plant *Indigofera tinctoria* L.; a) root, b) stem, c) grain,

table 2

Difference between protein content of *Indigofera tinctoria* and other legumes [5].

№	Type of plant and crop	Protein
1	Soybean (grain)	29
2	<i>Indigofera tinctoria</i> (grain)	26
3	Russian peas (grain)	20
4	Beans (grain)	18
5	Alfalfa (blue mass)	3

Presentation of the results obtained in the form of a diagram shows how close or different the amount of protein is in these plant organs. Below are the diagrams.

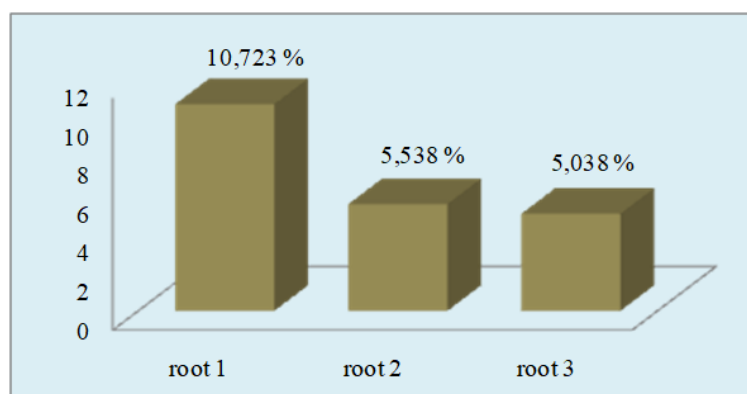


Figure 2. Protein of *Indigofera tinctoria* roots grown in 3 experimental plots

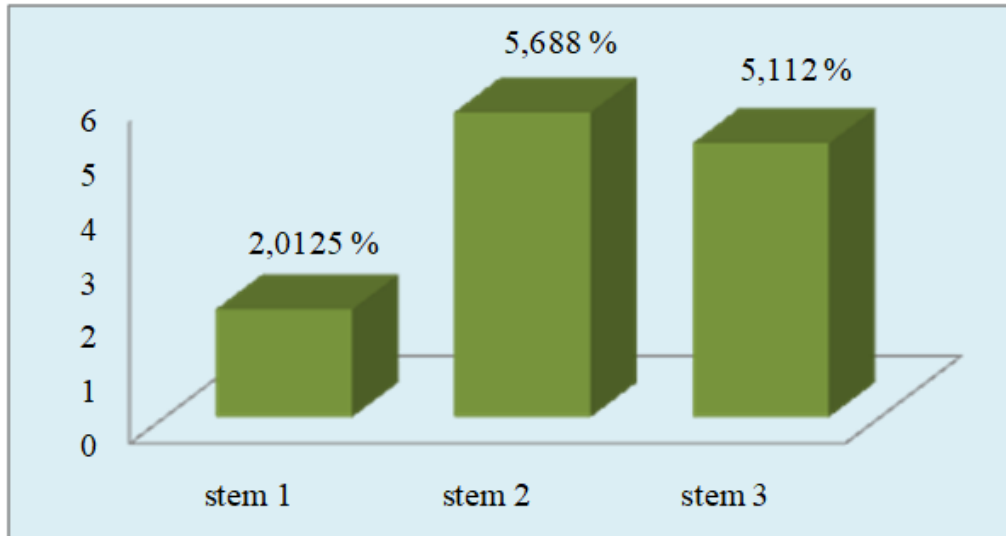


Figure 3. Protein of Indigofera tinctoria stems grown in 3 experimental plots

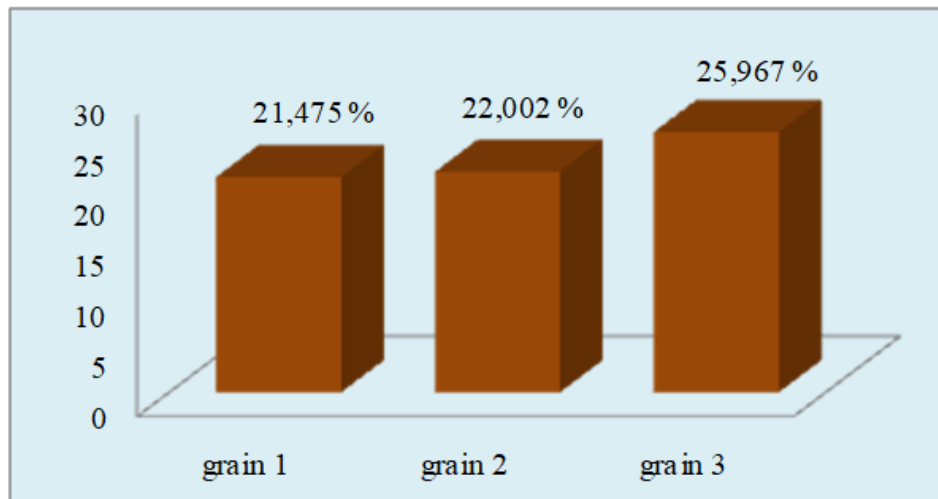


Figure 4. Protein of Indigofera tinctoria grains grown in 3 experimental plots

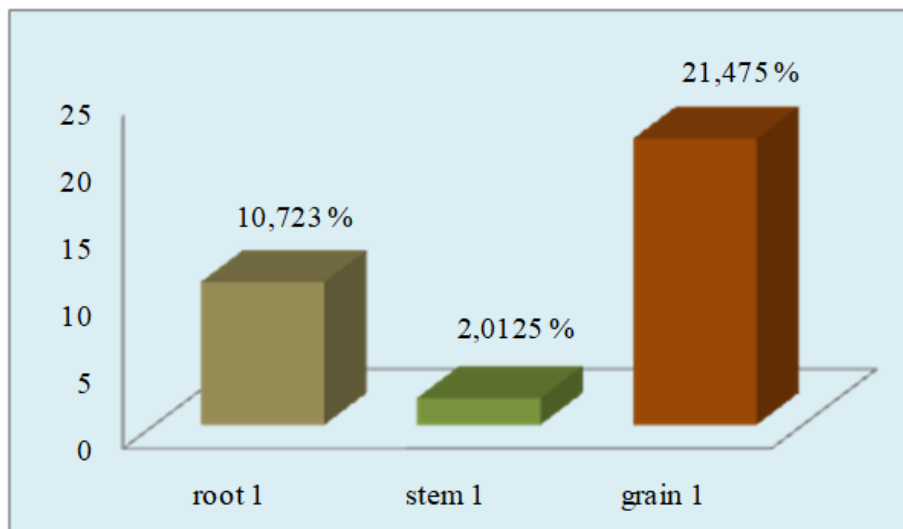


Figure 5. Protein content of the Indigofera tinctoria plant at the 1st experimental site

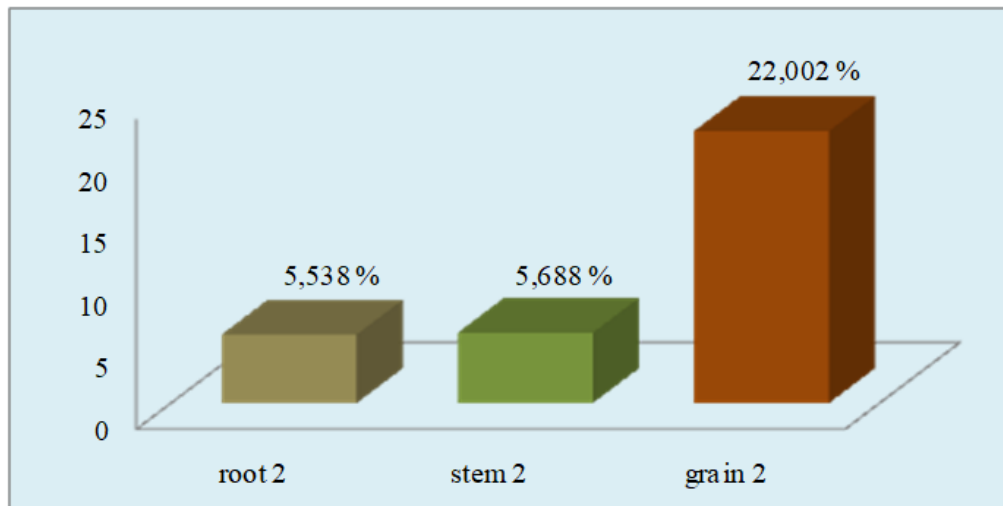


Figure 6. Protein content of the *Indigofera tinctoria* plant at the 2nd experimental site

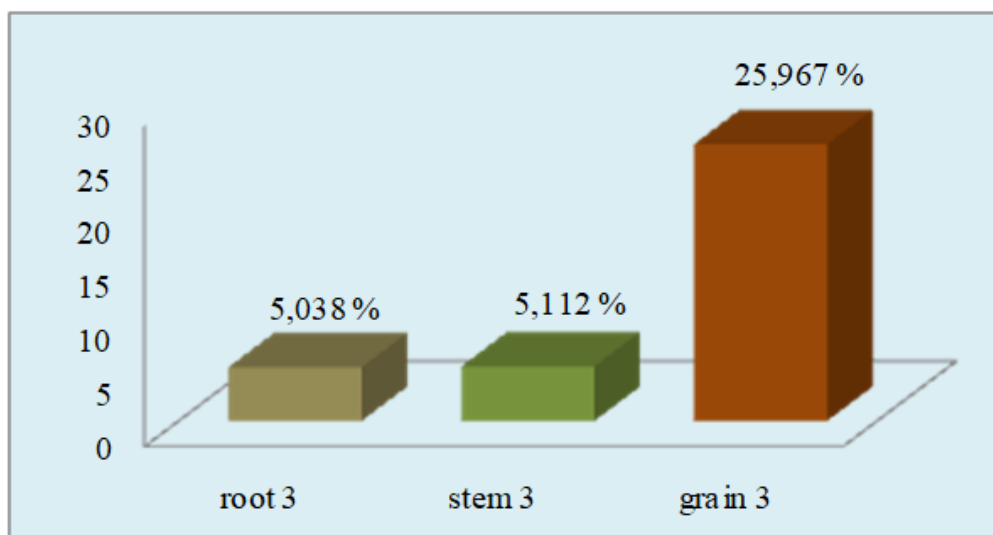


Figure 7. Protein content of the *Indigofera tinctoria* plant at the 3rd experimental site

CONCLUSION

When comparing the total protein content of *Indigofera tinctoria* grown in three experimental areas, it was found that the grain grown in the Sarykorgan region (dry and rocky area) has the highest content - 25.967% and the lowest amount 2.0125% was found in the stem grown in territory of the farm “Abdurazzok-Mukhtarjon Yuksalish” (fertile area). When comparing the number of proteins in the roots, the highest content - 10.723% was found in the roots grown on the territory of the Abdurazzok-Mukhtarjon Yuksalish farm; when comparing the stems, it was found that the highest figure was 5.688% in the stem of a plant grown in the Dangara region (saline soil), and when comparing grains, it was found that the highest content - 25.967% - has grain grown in the Sarykorgan region.

When comparing root-stem-grain parts of *Indigofera tinctoria* from each region, the total protein content increased in the second and third experimental sites, respectively. At the first experimental site, it was found that the average amount is in the root, the smallest in the stem and the largest in the grain.

Thus, in the roots of plants of the genus *Indigofera tinctoria*, grown on fertile soils, more protein accumulates than in saline and dry soils; on saline soils, more protein accumulates in the

stem, and on dry areas of the earth's surface, for example, hilly areas, more protein accumulates in the grain of the plant. squirrel.

REFERENCES

1. Alagbe John //Chemical evaluation of proximate, vitamin and amino acid profile of leaf, stem bark and root of *indigofera tinctoria*// International Journal on Integrated Education. Volume 3, Issue X, Sumitra Research Institute, Gujarat, India. October 2020. 150-157.
2. Veena Sharma and Aaastha Agarval //Physicochemical and Antioxidant Assays of Methanol and Hydromethanol Extract of Ariel Parts of *Indigofera Tinctoria Linn*// Journal of Pharmaceutical Sciences. Indian 2015. 729-734.
3. M.K. Gafar, A.U. Itodo, F.A. Atiku, A.M. Hassan and I.J. Peni //Proximate and Mineral Composition of the Leaves of Hairy Indigo (*Indigofera astragalina*)// Pakistan Journal of Nutrition 10 (2) 2011. 168-175.
4. Методы контроля. Химические факторы. Руководство по методам контроля качества и безопасности биологически активных добавок к пище. Руководство Р 4.1.1672-03. М.: Федеральный центр госсанэпиднадзора Минздрава России, 2004.
5. Sattorov J., Sidiqov S., Abdullayev S. va boshqalar. Agrokimyo. Darslik .– Toshkent : “Cho'lpon”., 2011. 56-b.
6. Джумаев Ф.Х., Атаева З.А. Выращивание растения «*Indigofera tinctoria L*» и его роль в повышении плодородия почв в условиях Бухарской области // Вестник науки и образования № 3(106). Часть 2. 2021. –С. 6-8
7. Гиляров М. С. *indigofera*. Биологический энциклопедический словарь, 1986, с. 229.
8. Yakubov G.K. Cultivation Indigofera in the soil and climatic conditions of Khorezm and the technology of obtaining a natural dye // Agrarian science for agriculture: collection of articles: in 3 books. / V International Scientific and Practical Conference (March 17-18, 2010) Barnaul: Publishing house of AGAU, 2010. Book. 1. -S. 420-421.
9. <https://ru.frwiki.wiki/wiki/Indigotier>.
10. [http://www.absoluteastronomy.com/topics/Indigofera tinctoria](http://www.absoluteastronomy.com/topics/Indigofera_tinctoria)