**Abstract**

**Research Title :** Soil Quality Comparison where Brazil nuts growing with different densities and different structural of Brazil nuts.

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Soil Quality Comparison Study The areas where brazil nuts grow with different densities and different structural of Brazil nuts in each area. The objective is to study the relationship of Areas where brazil nuts grow at with different densities In the field of Ban Thung Na School, Nam Phut Sub district, Mueang Trang District, Trang Province. This case study about the soil pH, temperature, soil structure, soil retention, soil texture and macronutrients that are indicators of soil quality. In each area, the results of the study of the structural of brazil nuts growing, including leaves, stems and flowers, were found in high density growing (A), with a pH of 6.93 at a depth of 5 cm, with an average temperature of 30°c at a depth of 15 cm. The average temperature is 28°c. The soil structure was granular. Soil adhesion is friable. Soil texture was loam type, leaf size on average 71.7 mm, stem size on average 507.3 mm, average number of flowers 13 flowers. There was a difference in medium density growth of Brazil nuts (B) with a pH of 7.16 at a depth of 5 cm, an average temperature of 33°c at a depth of 15 cm, an average temperature of 30°c. The soil structure was granular. Soil adhesion was friable. The soil texture was sandy clay loam, the average leaf size was 37.5 mm, the average stem size was 418.3 mm, the average number of flowers was 8, and the area with low density of Brazil nuts (C) with a pH of 7.21. at a depth of 5 cm, average temperature 35°c at a depth of 15 cm with an average temperature of 32°c , soil structure is granular. Soil adhesion was friable. Soil texture was sandy loam type, average leaf size 28.6 millimeters, average stem size 297.6 mm. Average number of flowers 6 flowers.

**Keywords**: Brazil nut, ground plant, soil quality.

**Introduction**

**Brazil nut (Arachis pintoi)** is a ground plant that drought tolerant, shade tolerant, and trampling tolerant. It has beautiful yellow flowers, suitable for garden cover, ground cover, ornamental gardening and can be planted instead of lawns. "Amarillo beans" is a tree imported from central Brazil. Brazil nuts, some called Pinto beans or Peru nuts, are perennials. It looks like Peanut appearance but has smaller leaves and stems slithering along the soil. Have strong root and grows well in all soil. Propagated by seeds or by cuttings. But in Thailand propagated by the use of rods. Have outstanding features It is a ground cover plant, drought tolerant, water tolerant, shade tolerant, resistant to trampling. It has beautiful yellow flowers, suitable for ornamental gardening and planting instead of lawns. In Ban Thung Na School, Brazil nuts grow in many areas. Each area has a different density. Therefore, the researcher was interested to study that the soil quality of each area affects the density of Brazil nuts or not.

The researchers studied data on the growth of Brazil nuts in 3 areas in Ban Thung Na School field. The research team recognizes the importance and differences of Brazil nuts structure and soil texture in each area. The researchers divided the study area into 3 areas and study the structural texture of Brazil nuts, pH, temperature, nitrogen, and phosphorus and potassium values in the soil that is an indicator of soil quality.

**Research objectives** to study the relationship of areas where brazil nuts grow with different densities affecting the quality of the soil in the field of Ban Thung Na School.

**Research questions How** is Brazil nuts grow differently in soil quality in each area of ​​Ban Thung Na School field?

**Research hypothesis If** Brazil nuts are grown in different areas Therefore, the quality of the soil will be different.

**Materials and equipment and methods of conducting research**

1) Measuring 2) meter cartridges

3) Straw rope 4) Erlenmeyer Flask

5) Moisture meter 6) Geo-coordinate measuring machine

7) Vernier Calipers 8) Compass

9) Calculator 10 ) Marker

11) Spade 12) Color calibration

13) Thermometer 14) pH Test Kit for Soils

15) Weight scale 16) Area of ​​10\*10 sq m.

17) Soil fertility measurement kit 18) Photographic equipment

19) Notebook and stationery 20) Soil sample canister

21) Glass stirrer 22) Beaker

23) Filter Paper 24) Funnel

25) Test Tube

**Measuring Method** (**Protocols)**

* Pedosphere (Soil)
* Methodology Biosphere Soil Cover Measurement Methodology Determination

**Research methods**

Area where brazil nuts grow In the field of Ban Thung Na School, Nam Phut Sub-district, Mueang District, Trang Province, the field will be conducted to collect samples in 3 areas, where Brazil nuts grow; High density (A) where Brazil nuts grow medium density (B) and where Brazil nuts grow low density (C).

**Research methods**

1. Research preparation stage

1) Choose a topic to be studied

2) Study about knowledge and theories related to research

3) Determine the purpose of the study

4) Determine the sampling in the study area.

2. Action steps

1) Make a research plan

2) Conduct a survey of the research area

3) Collect samples for measurement the relevant factors that must be studied, measured, geographic soil temperature in each soil depth. Soil fertility in each area, NPK, soil structure, soil retention and soil texture, and characterization of Brazil nut cover crops. The study time was 9:00 a.m. – 11:00 a.m.

**Soil sample collection and cover crop survey**

1. Determine the soil sampling area and the Brazil nut cover survey area.

2. Samples were collected once a week. All samples were collected 3 times from the school grounds. Soil samples were collected in the area along size 10\*10 square meters, 3 areas in each study area. Dig to a depth of about 15 cm. Put the soil in a plastic glass, cover the glass.

3. Measure the pH of the soil by taking 1 tablespoon of the collected soil dissolved in distilled water 20 ml. Then use universal indicator paper dipped in the solution and soak it for about 30 seconds, then compare the color with the standard value on the side of the box.

4. Measure the temperature of the soil. Dig into a depth of about 15 cm. Take a thermometer. For measuring the temperature at a depth of 5 cm. and 15 cm. by inserting it into the prepared soil trench, wait 1 minute, read the first soil temperature and read the time. Record in the notebook. Read the soil temperature 2 more times, waiting for only 1 minute of reading time. If all 3 times differ by less than 1 degree Celsius, it is considered acceptable.

5. Measure the amount of nitrogen, phosphorus and potassium in the soil. The collected soil was dissolved with distilled water with a soil: water ratio of 1:5 filter with filter paper. And then examined with a nitrogen test kit. Phosphorus and Potassium. By comparing with the standard.

6. Study the soil structure, soil texture Soil adhesion measurement Soil classification by field exposure method, soils were collected in all 3 areas with data collected up to 3 times to find the mean and then recorded.

7. To study the structural of Brazil nuts. Measure the width of the sheet leaf plate length the length of the radiating joints of the trunk. The number of flowers of the Brazil nut plant the size of the leaf and the size of the stem were measured using the Vernier Calipers. And counting the number of flowers in all 3 areas with data collected up to 3 times to find the mean. The values ​​were then recorded.

**Analysis and conclusion of the research**

1) The collected data were analyzed and compared with the correlation. The statistics used in the data analysis were average soil pH, soil temperature. Average nitrogen, phosphorus and potassium in soil, soil structure, soil retention. Classification of soil texture and structural characteristics of Brazil nuts

2) The tables averages of comparative data

3) Summarize

**Geographical coordinates.** The study was conducted in areas where Brazil nuts grow. In the field at Ban Thung Na School, Muang District, Trang Province, where Brazil nut grows, it consists of 3 areas.has the coordinates as in Table 1

**Table 1** Geographic Coordinates

|  |  |  |
| --- | --- | --- |
| **Brazil nut**  **Growing Area** | **area Geographic coordinates** | |
| **Latitude (N)** | **Longitude (E)** |
| High density (A) | 7.6953 | 99.73935 |
| Medium density (B) | 7.6939 | 99.73888 |
| Low density (C) | 7.6938 | 99.73936 |

**Soil pH**

The results of the studySoil pH was found that the high density (A) had a pH of 6.93 , the medium density (B) had a pH 7.16 , and the less dense area(C) had pH value 7.21 is shown in Table 2.

**Table 2** Soil pH in

|  |  |  |  |
| --- | --- | --- | --- |
| **Brazil nut**  **Growing Area** | **Brazil nut**  **growing** | **Depth - final (cm)** | **Average soil pH** |
| High density (A) | High density (A) | 15 | 6.93 ± 0.29 |
| Medium density (B) | Medium density (B) | 15 | 7.16 ± 0.29 |
| Low density (C) | Low density (C) | 15 | 7.21 ± 0.29 |

**Temperature in each soil depth**

The results of the study At a depth of 5 cm, brazil nut dense growth (A) averaged 30°c, average brazil nut growth(B) average 33°c. Mild(C) average temperature 35°c at a depth of 15 cm. Brazil nut dense growth (A) average 28°c, average Brazil nut growth medium (B) 30 average, the low density of Brazil nuts(C) had an average temperature of 32°c, shown in Table 3.

**Table 3 :** The temperature in each soil depth.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Brazil nut**  **Growing Area** | **Depth**  **starting - final (cm)** | **Soil temperature (degrees Celsius)** | | | | |
| **No. 1** | **No. 2** | **No. 3** | **Average** |
|
| High density (A) | 5 | 30.00 | 30.00 | 30.00 | 30.00 ± 0.00 |
| 15 | 28.00 | 28.00 | 28.00 | 28.00 ± 0.00 |
| Medium density (B) | 5 | 33.00 | 33.00 | 33.00 | 33.00 ± 0.00 |
| 15 | 30.00 | 30.00 | 30.00 | 30.00 ± 0.00 |
| Low density (C) | 5 | 35.00 | 35.00 | 35.00 | 35.00 ± 0.00 |
| 15 | 32.00 | 32.00 | 32.00 | 32.00 ± 0.00 |

**Soil fertility**

Nitrogen

1. Nitrogen measurement in areas with very dense growth of Brazil nuts (A), the nitrogen content was moderate. The area with moderate density of Brazil nuts (B) had low nitrogen content. Areas with low density of Brazil nuts (C) had moderate nitrogen content. The values ​​are shown in Table 4.

2. Phosphorus

Phosphorus determination in areas with very dense growth of Brazil nuts (A), their phosphorus values ​​were very low. The area with moderate density of Brazil nuts (B) was low in phosphorus. Areas with low density of Brazil nuts (C) were low in phosphorus. The values ​​are shown in Table 4.

3 Potassium

Determination of potassium Areas densely growing Brazil nuts (A) are high in potassium. Moderately dense areas of Brazil nuts (B) were low in potassium. Areas with low density of Brazil nuts (C) with low potassium values ​​are shown in Table 4.

**Table 4** Soil fertility in each region NPK

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Brazil nut**  **Growing Area** | **Depths, initial-final depth (cm.)** | **Soil fertility** | | |
| **nitrogen** | **phosphorus** | **potassium** |
| High density (A) | 15 | Medium | very low | high |
| Medium density (B) | 15 | Low | low | low |
| Low density (C) | 15 | Medium | low | low |

**Soil structure, Soil retention and Soil texture**

The study of soil structure, soil adhesion and soil texture revealed that the soil structure in all areas where Brazil nuts grew. Soil adhesion is crumbly in all areas. The nature of the soil Brazil nut high density (A) loam, medium-density Brazil loam (B) sandy clay loam, low-density brazil loam (C) sandy loam. As in Table 5

**Table 5** Soil structure, soil retention and soil texture

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Brazil nut**  **Growing Area** | **Brazil nut**  **Growing Area** | **initial-final depth (cm.)** | **Soil structure, soil** | **retention, soil** | **texture,** |
| High density (A) | High density (A) | 15 | granular | sandy loam | Loam |
| Medium density (B) | Medium density (B) | 15 | granular | sandy loam | Sandy Clay Loam |
| Low density (C) | Low density (C) | 15 | granular | sandy loam | Sandy Loam |

**Brazil nut**

The results of the study Structure of Brazil nuts, divided into 3 areas, studied: leaf size, Brazil nut growth (A), average leaf size 71.7 mm, average Brazil nut growth (B) leaf size average 37.5 mm Brazil nut (C) average leaf size 28.6 mm., stem size (A) 507.3 mm., average Brazil nut (B) Average stem size 418.3 mm. Low density Brazil nut area (C) Average stem size 297.6 mm. Number of flowers. Average 13 flowers, medium-density Brazil nut (B) average 8 flowers, low average Brazil nut (C) 6, shown in Table 6. Table 7 and Table 8

**Table 6** Average leaf size

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Brazil nut**  **Growing Area** | **size of brazil nut leaves**  **Sheet width X leaf length (mm)** | | | |
| **No. 1** | **No. 2** | **No. 3** | **Average** |
|
| High density (A) | 81.4 | 77.7 | 56.1 | 71.7 |
| Medium density (B) | 38.4 | 44.2 | 29.9 | 37.5 |
| Low density (C) | 32.2 | 22.8 | 30.8 | 28.6 |

**Table 7** Average trunk size

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Brazil nut**  **Growing Area** | **Size of Brazil nut leaves**  **Stem length X trunk spread (mm)** | | | |
| **No. 1** | **No. 2** | **No. 3** | **Average** |
|
| High density (A) | 567 | 575 | 380 | 507.3 |
| Medium density (B) | 525 | 378 | 352 | 418.3 |
| Low density (C) | 368 | 450 | 75 | 297.6 |

**Table 8** Average number of flowers

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Brazil nut**  **Growing Area** | **Number of brazil pea flowers** | | | |
| **No. 1** | **No. 2** | **No. 3** | **Average** |
|
| High density (A) | 12 | 13 | 13 | 13 |
| Medium density (B) | 6 | 7 | 11 | 8 |
| Low density (C) | 5 | 6 | 7 | 6 |

**Conclusion and discussion of the results.**

**1. Soil fertility**

1. Nitrogen; it was found that the area with high density (A) had moderate nitrogen value. Brazil nut dense, medium (B) low nitrogen content and Brazil nut growth area Low density (C) Moderate nitrogen content in all regions with nutrient constituents for good growth of Brazil nuts. Keeps plants green increase photosynthesis Accelerate the growth of leaves and stems.

. 2. Phosphorus; it was found that the area with very dense growth of Brazil nuts (A) had very low phosphorus values. The area of ​​Brazil nut dense growth was moderate (B), low in phosphorus and areas where Brazil nuts grow low density (C), low phosphorus content The uptake by plants depends on the acidity or alkalinity of the soil. Helps the growth of the root system As a result, the trunk is strong to stimulate [flowering](http://www.xn--12cg1cxchd0a2gzc1c5d5a.net/%E0%B8%94%E0%B8%AD%E0%B8%81%E0%B9%84%E0%B8%A1%E0%B9%89%E0%B8%9B%E0%B8%A3%E0%B8%B0%E0%B8%88%E0%B9%8D%E0%B8%B2%E0%B8%8A%E0%B8%B2%E0%B8%95%E0%B8%B4%E0%B8%AD%E0%B8%B2%E0%B9%80%E0%B8%8B%E0%B8%B5%E0%B8%A2%E0%B8%99/) very well.

3. Potassium. Studies have shown that Areas where Brazil nuts grow Very dense (A) has a high potassium value. Areas where Brazil nut grows are moderate (B) with low potassium values.And areas where Brazil nuts grow less dense (C) has a low potassium value. This is because the plants in each area absorb potassium to help transport sugar and starch, increase weight, high yield, and prevent plant wilt. Help plants resist various diseases and help plants tolerate inappropriate environmental conditions.

**2. The pH of the soil**

From the study found, areas where Brazil nuts grow high dense (A) with a pH of 6.93 suitable for growing Brazil nuts. The soil acidity Help plants absorb various minerals in the soil for better use.

**3. The temperature in each depth of soil.**

The study found that at a depth of 5 to 15 centimeters where Brazil nuts grow high dense (A) suitable temperature on the growth of Brazilian soybeans.

**4. Soil structure, soil adhesion and soil texture.**

The study found that soil structure in all areas where Brazil nuts grow granular Soil adhesion is crumbly in all areas. High dense Brazil nut growth (A) is loam. Medium dense Brazil nut (B) is sandy clay loam. Low density Brazil nut (C) is clay loam sandy. All soils are suitable for growing Brazil nuts that depending on the differences soil fertility.

**5. Brazil nut plants**

The study found that Growing Brazil Nuts Each area will be different. Due to the quality of the soil the structure of the Brazil nut is different. The area where Brazil nuts grows is high dense. (A) The size of the leaf plate is large, the joints are long. The spread of the trunk is large. A lot of flowers medium dense growth of Brazil nuts (B). The leaf size is medium. The joints are of medium length. The spread of the trunk is medium. The flowers are moderate. Areas with low density of Brazil nuts(C) the size of the leaf plates is small. The spread of the trunk is less flowers due to different soil quality. The growing ability of Brazil nuts is therefore different. Brazil nuts can be grown in any soil, drought tolerant, waterlogged, and shade tolerant, trampling tolerant with beautiful yellow flowers Helps fix nitrogen in the soil.

**Summary of research results**

From the research, it was concluded that in densely growing areas of Brazil beans (A), pH 6.93 at a depth of 5 cm, an average temperature of 30°c at a depth of 15 cm, an average temperature of 28°c. The soil structure is globular. Soil adhesion is crumbly. Characteristics of soil texture: Loam type, leaf size on average 71.7 mm, stem size on average 507.3 mm, average number of flowers 13 flowers. Medium dense growth of Brazil nuts (B) with a pH of 7.16 at a depth of 5 cm, an average temperature of 33°c at a depth of 15 cm, an average temperature of 30°c. The soil structure was globular. Soil adhesion is Sandy Loam. The soil texture was Sandy Clay Loam, the average leaf size was 37.5 mm, the average stem size was 418.3 mm, the average number of flowers was 8, and the area with low density of Brazil nuts (C) had a pH of 7.21. Depth 5 cm, average temperature 35°c, depth 15 cm, average temperature 32°c, soil structure is granular. The soil texture is Sandy Loam type. The average leaf size is 28.6 mm. The average stem size is 297.6 mm. The average number of flowers is 6,

Resulting in a densely growing of Brazil nut (A) having an appropriate ph. value soil acidity suitable temperature the nature of the soil texture is loam, so it has pigments that help plants absorb various minerals in the soil for better use. The structure of Brazil nuts, leaves, stems, flowers grow best. Moderately dense areas of Brazil nut (B) with optimum pH, soil acidity. Suitable temperature Characteristics of the soil texture is sandy loam. The structure of the Brazil nut, leaves, stems, flowers, good growth. Areas with the lowest density of Brazil beans (C), suitable soil acidity. Suitable temperature of the soil texture is sandy loam. The structure of Brazil nuts, leaves, stems, flowers, growth in all 3 areas with different density of Brazil nuts with the quality of different soils.

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**Reference Document**

Department of Lands. **Soil acidity**. [online]. Retrieved from

<http://www.bwc.ac.th/e-learning/virachai/phdin.html>

Research Laboratory and Plant Experimental Greenhouse. **Brazil Nuts** [online]. Retrieved from http://www. http://clgc.agri.kps.ku.ac.th/resources/ornament/arachis.html

Department of Lands. (2013). **Soil quality inspection.** [online]. Retrieved from

https://osd101.ldd.go.th/osdlab/wikipedia

. **Ground cover plants** [online]. Retrieved from

https://en.wikipedia.org/wiki/Cover plants.