Research Article

Effect of mulching on early development of beans 
(Phaseolus vulgaris L.) seeds, in keffi, Nasarawa state

Chukwudi J. Onovo¹, Gabriel G. Mowobi¹*, Charles Osuji², 
Abubakar Salisu², Ombugadu N. Adama¹

¹Nasarawa State University, Keffi, Department of plant science and biotechnology, PMB. 1022, Nasarawa State, 
Nigeria 
²Biotechnology and Genetic Engineering Advanced Laboratory, Sheda Science and Technology Complex, PMB. 186, Garki, Abuja, Nigeria

*For correspondence
Gabriel G. Mowobi, 
Nasarawa State University, 
Keffi, Department of plant science and biotechnology, PMB. 1022, Nasarawa State, 
Nigeria. 
Email: mowobig@gmail.com

ABSTRACT

Objective: To study the effect of mulching on early development of beans seeds.

Methods: Two types of mulches were used these are; Mulch from bark of tree (MB) and mulch from leaves (ML). The study was conducted at the Botanical Garden of Plant Science and Biotechnology of Nasarawa State University Keffi. The experiment was conducted in a complete randomized design with three (3) treatments; MB, ML and MO, and replicated three times. Data were collected on root length, stem height, branch length and number of leaves.

Results: Fourteen (14) days after planting (DAP), there was significant (P <0.05) difference on the growth of the plant. 14 DAP, the soil treated with MB recorded highest root length (8.68 cm), stem height at 14DAP was highest with treatment of ML (11.40 cm) and those treated with MB also recorded the highest length of branches (8.38 cm). The number of leaves 14DAP of MB and ML shows a fairly similar result (7.00 and 7.33 respectively). So generally, MB and ML are recommended as good sources of mulching.

Conclusions: From the outcome of the study, it can be concluded that the addition of mulch to soil greatly increases the property of soil which will enhance food production.

Keywords: Mulching, Early development, Phaseolus vulgaris, Beans seed

Introduction

Phaseolus vulgaris L. (common bean) is also known as string bean, field bean, flageolet bean, French bean, garden bean, haricot bean, pop bean or snap bean.⁻ It is an herbaceous annual plant grown worldwide for its edible dry seed or unripe fruit that are both known as “bean”. Phaseolus species is a member of the family Fabaceae, genus Phaseolus and specie vulgaris most of whose member acquire the nitrogen they require through an association with rhizobia, a
species of nitrogen-fixing bacteria. Bush varieties form erect bushes 20-60 cm tall, running varieties form vines 2-3 m long. All varieties bear alternate, green or purple leaves, which are divided into three oval, smooth-edged leaflets, each 6-15 cm long and 3-11 cm wide. The white, pink, or purple flowers are about 1 cm long, and they give way to pods 8-20 cm long and 1-1.5 cm wide. These may be green, yellow, black, or purple in color, each containing 4-6 beans.

Mulch is used to improve the fertility and health of a soil. It can also be used to reduce weed growth and enhance visual appeal of the area. Mulch is usually but not exclusively organic in nature. It may be permanent (plastic sheeting) or temporary (bark of trees and leaves). It may be applied to bare soil, or around existing plants. Mulches of manure or compost will be incorporated naturally into the soil by the activities of worm and other organism. Dorling reported that mulch process is used both in commercial crop production and in gardening and when applied correctly it improved soil fertility. Ruth reported that mulch is the gardener’s greatest time saver; just make sure it does not monopolize all the nitrogen. Some mulch is tilled into the soil before planting a new crop and therefore may have an effect among soil fertility and soil chemistry. In the short term, mulches may decrease nitrogen availability of a given crop and may for a while negatively affect plant growth. A material that has high carbon content and is very low in nitrogen and other nutrient may “bind” or immobilize plant-available nitrogen temporarily. This occurs because soil microorganisms use available nitrogen to metabolize and decay the organic material. The immobilized organic nitrogen can be made available (mineralized) later as the organic matter continues to decompose. In order to maximize the benefits of mulch, while minimizing its negative influences, it is often applied in late raining/eariy dry season when soil temperature has risen sufficiently, but soil moisture content is still relatively high.

Organic mulches are preferred to inorganic materials due to their soil enhancing properties. Organic mulches decay over time and are temporary. The way organic mulch decomposes and reacts to wetting by rain and dew affects its usefulness. Some mulches such as straw, sawdust and other wood products may for a while negatively affect plant growth because of their wide carbon to nitrogen ratio because the bacteria and fungi that decompose the materials remove nitrogen from the surrounding soil for growth. Ruth, reported that whether this effect has any practical impact on gardens is disputed by researchers and the experience of gardens. Organic matter can increase cation exchange capacity (CEC). It also may increase availability of phosphorus in soils. Organic material and a higher CEC can reduce leaching of some organic and cationic pesticides. In some cases, the temporary decrease in nitrogen availability may reduce nitrogen leaching losses below the root zone.

Materials and Methods

Study area

The study was carried out at the Plant Science and Biotechnology Botanical Garden of Nasarawa State University, Keffi, Nasarawa State Nigeria. Keffi is a Local Government Area in Nasarawa State, which is located in the middle belt of Nigeria. It is geographically situated on latitude of 8°5′N and longitude 7°5′. The temperature range is between 25°C – 31°C and about 602 mm of precipitation falls annually. The soil types predominantly found in Keffi are sandy soil and silt loamy. It is in the Northwest of Lafia, the state capital of Nasarawa State.

Materials

The common beans (Phaseolus vulgaris L.) used was obtained from the Agricultural research project (ADP) Keffi. The required mulch types (Mulch from bark of tree (trunk) and mulch from leaves) needed was collected from a mango tree.

Method

The required mulch types (Mulch from bark of tree and mulch from leaves) needed were collected from a mango tree and allowed to dry
under the sun. After drying, the mulches were pounded and the required grams (80 g) of each were weighed. The pots were filled with 4 kg of soil sample (loamy soil), which were sieved using a wire mesh so as to remove stones and other debris and to also avoid any presence of mulch in the soil and the mulch treatments were applied accordingly. The mulches were allowed to decompose before the seeds were sown. The beans seeds were sown 2 cm deep per pot in a regular pattern and moisture level was maintained by watering the seeds daily.

Data collection

After fourteen (14) days of planting, the following data was collected

i. Average length of root per treatment.

ii. Average height of stem per treatment.

iii. Average length of branches per treatment.

iv. Average number of leaves per treatment.

v. Readings were carried out through observation and the use of thread and meter rule.

Results and Discussion

Fourteen (14) days after planting (DAP), the effect of mulching on root length of \( P. vulgaris \) L. based on the average performances of roots per treatment (Table 1) show that MO recorded 3.60 cm, MB 8.68 cm and ML 8.35 cm. From these treatments the observable variance was a dramatic growth in root length of MB and ML where each average length of roots nearly doubled that of MO. 14 DAP, the length of root was significantly \((P < 0.05)\) affected the treatments applied. The significant difference in root length is as a result of the bark and leaves used as mulches. Both MB and ML shows a high responds on the early development of root of \( P. vulgaris \) L. This result conform with a study conducted by Zakaria \textit{et al.} to investigate the effect of different ratios of municipal solid waste compost on growth parameters and yield of marigold also confirmed the potential of compost in improving growth parameter of crops.10

14 DAP, the effect of mulching on stem height of \( Phaseolus vulgaris \) L. based on the average performances of stem per treatment (Table 2)
also revealed that MO recorded 8.48 cm, MB 10.62 cm and ML 11.40 cm. MB and ML treatments showed relatively same effect on the height of stem, recording a high response in height of stem of *Phaseolus vulgaris* L. to that of MO treatment. There was significant (P < 0.05) difference in the stem height is also as a result of the mulch types applied.

### Table 1: Effect of mulching on root length of *Phaseolus vulgaris* L.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Mulch(g)</th>
<th>Ave. length of root per treatment (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loamy soil/MO</td>
<td>-</td>
<td>3.60(^c)</td>
</tr>
<tr>
<td>Loamy soil/MB</td>
<td>80</td>
<td>8.68(^a)</td>
</tr>
<tr>
<td>Loamy soil/ML</td>
<td>80</td>
<td>8.35(^b)</td>
</tr>
</tbody>
</table>

LSD (P < 0.05) *=*  
\(a \sim c\) are levels of significant in each column  
*= significant difference (P < 0.05)

Key: MO = Control (Mulchless); MB = Mulch from bark of tree; ML = Mulch from leaves.

The effect of mulching on branch length of *Phaseolus vulgaris* L. based on the average performances of branches per treatment at 14 DAP (Table 3), revealed that MO recorded 2.05 cm, MB 8.38 cm and ML 7.98 cm. Observable variance was a dramatic growth in length of branches of MB and ML where each average length tripled that of MO. Though mulch treatments (MB and ML) showed no much variance of effect on the branch length, but 14 DAP the length of the branches were significantly (P < 0.05) affected as a result of the treatments applied.

The effect of mulching on number of leaves of *Phaseolus vulgaris* L. based on the average performances of leaves per treatment as shown in table 4 also revealed that MO recorded 5.00, MB 7.00 and ML 7.33. 14 DAP the number of leaves were significantly (P < 0.05) affected by the treatments applied. Both MB and ML showed similar effect on early development in number of leaves, also recording a high response of growth to that of MO.

### Table 2: Effect of mulching on stem height of *Phaseolus vulgaris* L.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Mulch(g)</th>
<th>Ave. height of stem per treatment (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loamy soil/MO</td>
<td>-</td>
<td>8.48(^c)</td>
</tr>
<tr>
<td>Loamy soil/MB</td>
<td>80</td>
<td>10.62(^b)</td>
</tr>
<tr>
<td>Loamy soil/ML</td>
<td>80</td>
<td>11.40(^a)</td>
</tr>
</tbody>
</table>

LSD (P < 0.05) *=*  
\(a \sim c\) are levels of significant in each column  
*= significant difference (P < 0.05)

Key: MO = Control (Mulchless); MB = Mulch from bark of tree; ML = Mulch from leaves;

### Table 3: Effect of mulching on branch length of *Phaseolus vulgaris* L.

<table>
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<th>Treatment</th>
<th>Mulch(g)</th>
<th>Ave. length of branch per treatment (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loamy soil/MO</td>
<td>-</td>
<td>2.05(^c)</td>
</tr>
<tr>
<td>Loamy soil/MB</td>
<td>80</td>
<td>8.38(^a)</td>
</tr>
<tr>
<td>Loamy soil/ML</td>
<td>80</td>
<td>7.98(^b)</td>
</tr>
</tbody>
</table>

LSD (P < 0.05) *=*  
\(a \sim c\) are levels of significant in each column  
*= significant difference (P < 0.05)

Key: MO = Control (Mulchless); MB = Mulch from bark of tree; ML = Mulch from leaves;

### Table 4: Effect of mulching on number of leaves of *Phaseolus vulgaris* L.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Mulch(g)</th>
<th>Ave. no. of leaves per treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loamy soil/MO</td>
<td>-</td>
<td>5.00(^c)</td>
</tr>
<tr>
<td>Loamy soil/MB</td>
<td>80</td>
<td>7.00(^b)</td>
</tr>
<tr>
<td>Loamy soil/ML</td>
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<td>7.33(^a)</td>
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LSD (P < 0.05) *=*  
\(a \sim c\) are levels of significant in each column  
*= significant difference (P < 0.05).

Key: MO = Control (Mulchless); MB = Mulch from bark of tree; ML = Mulch from leaves.
From this study, the presence of mulch in the soil significantly affected the early development of common beans seeds in all parameters. However, observable features show that the mulch types had no remarkable difference. These results are in agreements with the findings of some researchers.3,7

Conclusions

From the results gathered, the mulchless treatment (MO) had lower effect on the growth parameters observed than the mulch from bark of tree (MB) and mulch from leaves (ML). The findings of this work shows that the properties of soil can be improved by the addition of mulch and that there is significant difference on the effect of mulching on early development of beans seeds. From the findings of this study, the use of mulch to enhance the early development of beans is a good agricultural practice that farmers in Keffi and its environs should adopt.

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Conflict of interest: None declared

References