Asian Journal of Research in Crop Science

Volume 8, Issue 2, Page 11-16, 2023; Article no.AJRCS.96405
ISSN: 2581-7167

Integration of Mungbean (*Vigna radiata* L.) as Cash Crop on Shaded Land Areas at Café Project in Conner, Apayao

Agustina G. Pattung [a*], Nathaniel Llamelo [a], Satur Bangyad [a], Ramon Dorado [a], Lea Balingit [a], Oliver Situt [a] and Adjustor Batara [a]

[a] Apayao State College, Malama, Conner, Apayao, Philippines.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJRCS/2023/v8i2160

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/96405

Original Research Article

Received: 04/12/2022
Accepted: 15/02/2023
Published: 18/02/2023

ABSTRACT

The study was conducted to determine the growth and yield of mungbean integrated as a cash crop in the Conservation Agriculture in Forest Ecosystem (CAFÉ) Project sites at Barangay Guina-ang, Conner, Apayao. The CAFÉ Project was launched with the intention of promoting environmentally sound farming practices in the uplands of Apayao. The four mungbean varieties: NSIC Mg 05 – Pag-asa 11, NSIC Mg 12 – Pag-asa 19, NSIC Mg 09 – Pag-asa 15, and NSIC Mg 17 – Pag-asa 17 were planted around 2 meters away from the nearest trees in partially-shaded areas with slopes not exceeding 50 degrees. It was laid out in 5 m x 10 m quadrants arranged in Randomized Complete Block Design (RCBD) with three replications. Results of the study revealed that V_1 and V_2 were late maturing (86.50; 87.16 DAT), taller (65.25; 68.85 cm), had more pods per plant (16.72; 15.92), longer pod length (9.42; 9.36cm) more seeds per pod (12.42; 10.88), heavier seed weight (33.46;

**Corresponding author: E-mail: tinbio05@yahoo.com;*

28.49g) and higher seed yield (656.45; 610.20 kg/ha) as compared to V_3 and V_4. In conclusion, NSIC Mg 05 – Pag-asa 11 and NSIC Mg 12 – Pag-asa 19 had better growth performance and yield in partially shaded areas integrated as a cash crop in the CAFÉ Project site at Conner, Apayao.

Keywords: Mungbean; cash crop; cropping combinations; maturity; yield.

1. INTRODUCTION

Mungbean (*Vigna radiata L*.) belongs to Family Leguminoceae whose determining characteristics is their ability to fix atmospheric nitrogen (N) [1]. Furthermore, mungbean seeds contain 24.7% protein, 0.6% fat, 0.9% fiber and 3.7% ash and a sufficient quantity of calcium, phosphorus and important vitamins. It has been a source of protein. Mungbean is an important short- duration crop in Pakistan [2].

In the Philippines, mungbean are small green legumes grown widely for use as a human food but can also be used as a green manure crop and as forage for livestock, source of animal feed and income [3,4]. It is a tropical or sub-tropical crop, and require warm temperatures, annuals, highly branched and having trifoliate leaves, upright and vine types of growth habit occur in mungbean, with plants varying from one to five feet in length. It is a drought-tolerant crop and requires a warm climate during its growing period [3]. Furthermore, mungbean is a crop with low soil requirements, a short reproductive cycle, high nitrogen fixation capacity, and environmental adaptability [5].

Large variability in cropping systems exists in rainfed dryland regions, with intercropping being more common. Furthermore, cropping systems have a significant impact on the sustainability of conservation agriculture [6]. The Conservation Agriculture in Forest Ecosystem (CAFÉ) Project established by Apayao State College aimed to promote environmentally sound farming systems model under forest canopy in the uplands of Apayao. Specifically, the CAFÉ project is a research cum demonstration farm for the College where crop combinations and integration of cash crops like mungbean under fruit and forest trees in mid elevation site in Guinaang, Conner, Apayao were established. The mungbean in the project was a cash crop and intercropped in partially shaded and rolling areas in order to maximize the utilization of the site as the fruit trees and other crops were present. Studies on mung bean under shading stress found out that morphological traits and physiological metabolism capacities were changed in response to shading stress. Plant mechanisms in response to shading stress, and these parameters could be used to evaluate mung bean cultivars for shading tolerance [7].

This study used four mungbean varieties evaluated for their growth and yield performance on the partially shaded areas of the CAFÉ Project in Barangay Guina- ang, Conner, Apayao.

1.1 Objectives

This study was conducted to determine the growth and yield of mungbean in shaded areas integrated as a cash crop in the CAFÉ Project site. Specifically, it was conducted to determine the performance of mungbean in the partially shaded areas in terms of growth duration, plant height, branches per plant, pods per plant, pod length, seeds per pod, the weight of 1,000 seeds and seed yield (t/ha).

2. METHODOLOGY

2.1 Selection of Mungbean Varieties

Four mungbean varieties which were commonly planted by the farmers in the locality were chosen as experimental plants. The seeds were procured at an agricultural store and were coded accordingly. The varieties were:

V_1- NSIC Mg 05 – Pag-asa 11
V_2- NSIC Mg 12 – Pag-asa 19
V_3- NSIC Mg 09 – Pag-asa 15
V_4- NSIC Mg 17 – Pag-asa 17

2.2 Experimental Treatments and Design

The mungbean experimental site was laid out in 5 m x 10 m quadrants arranged in Randomized Complete Block Design (RCBD) with three replications.

2.3 Planting

Mungbean seeds were planted on the 1st week of February using the traditional dibble method with an approximated distances of 12 inches x 12

inches on 2-3 seeds per hill. Replanting of missing hills was done within 7 days after seeding (DAS). Mungbean were planted around 2 meters away from the nearest trees.

2.4 Inter Tillage and Cultural Management

Weeding was done manually and the weed materials were used as mulching for the mungbean plants. Since the study area was in a hilly forest zone, the plants were dependent on rainfall for its water needs. The soil type is sandy clay loam.

2.5 Nutrient Management

Fertilizer application of complete (14-14-14) and urea (46-0-0) fertilizers at the rate of 20 grams per hill dibbled 3-4 inches away from the base of the plants was done at 25 DAS. Nitrogen fertilizer applied was absorbed and utilized by mung bean [5].

2.6 Harvesting and Determination of Yield

The matured dried pods were gathered on a priming basis, sun dried, threshed and winnowed to remove the trash. Cleaned seeds were sundried and weighted. Sample pods were also selected randomly per treatment for the data on other yield components.

2.7 Statistical Analysis of Data

Data gathered for various characteristics were subjected to Analysis of Variance using the SPSS Statistical Package and means were compared through the Duncans' Multiple Range Test (DMRT) at 5% level of probability [8].

3. RESULTS AND DISCUSSION

3.1 Growth Parameters

3.1.1 Growth duration

As gleaned in Table 1, V_2 had the longest duration to 87.16 days which was statistically similar with V_1 (86.50), while the V_3 and V_4 had a mean of 79.00 and 78.25 days, respectively. Data supports that V_1 and V_2 can be considered late maturing varieties while V_3 and V_4 matures early. Further, Analysis of Variation revealed that means between the different treatments in the CAFÉ project showed no difference while means between mungbean varieties were significant at 1% level DMRT with coefficient of variation computed at 0.35% and 4.58%, respectively. The study of [9] had almost similar data when the mungbean was planted on the early part of March.

3.1.2 Plant height (cm)

The tallest variety was observed on V_2 with mean of 68.85 cm followed by V_1 (65.25 cm), V_4 (51.20 cm) and V_3 with 49.20 cm, respectively. As observed, the late maturing varieties were also taller than the early maturing ones. The data gathered was parallel to the findings of [10] which reported that late maturing varieties had a plant height range from 56.60 – 60.30 cm while the early maturing was from 38.20 – 40.30 cm. Furthermore, the taller plants in the CAFÉ Project site may be attributed to the shading effect of the trees since the mungbean were planted around 2 meters away from the nearest trees. Plants that are subjected to a poor or localized light source become drawn or etiolated as they try to reach more light [11]. ANOVA computation showed that both the cropping combinations and mungbean varieties have significant difference at 5% level and coefficient of variation at 4.21% and 6.22% respectively. The morphological traits of the mungbean were significantly affected by shading stress. Due to shade stress, plant height and the length of the first internode were increased [7].

3.1.3 Branch per plant

More branches were recorded in early maturing varieties, V_3 with 3.45 and V_4 (3.32), than the late maturing varieties which posted 3.16 for V_1 and 3.28 for V_2. However, there was no significant difference in the means between the different mungbean varieties and the different cropping combinations of the CAFÉ Project.

3.2 Reproductive Parameters

3.2.1 Pods per plant

The late maturing varieties, V_1 and V_2 produced the most number of pods per plant with means of 16.72 and 15.98 as compared to the early maturing varieties V_4 (15.18) and V_3 (15.14). The result run with the findings of [10] which characterized the late maturing varieties as high yielding as brought about by the more number of pods per plant. Analysis of variation showed that means between the different mungbean varieties were significantly different at 5% level DMRT but there was no significance between the cropping combinations in the CAFÉ site where the varieties were planted.

Table 1. Growth parameters of mungbean integrated as a cash crop in the CAFÉ Project Site

Varieties	Growth Duration (days)	Plant Height (cm)	Branch per plant
V1	86.50a	65.25b	3.16
V2	87.16a	68.85a	3.28
V3	79.00b	49.4c	3.45
V4	78.25b	51.2c	3.32
c.v. (%)	4.58	6.22	1.14
Level of significance	0.01	0.05	ns

Table 2. Reproductive parameters of mungbean integrated as a cash crop in the CAFÉ Project Site

Varieties	Pods per Plant	Length of Pods (cm)	Number Seeds per Pod
V1	16.72a	9.56a	11.42a
V2	15.98a	9.36a	10.88b
V3	15.14b	7.24b	8.85c
V4	15.28b	7.56b	8.32c
c.v. (%)	3.85	5.24	8.67
Level of significance	0.05	0.01	0.01

3.2.2 Length (cm) of pods

Longer pods were observed from the late maturing varieties, V_1 (9.56) and V_2 (9.36), as compared to early maturing V_3 (7.24) and V_4 (7.56). This finding can be attributed to the characteristics of the mungbean HYVs [7]. Analysis of Variance revealed that means between the different treatments in the CAFÉ project showed no difference while means between mungbean varieties were significant at 1% level DMRT with the coefficient of variation computed at 1.96% and 5.24% , respectively.

3.2.3 Number of seeds per pod

Variety 1 (V_1) had the most number of seeds per pod with a mean of 11.42 followed by V_2 (10.88), V_3 (8.85) and V_4 (8.32). ANOVA showed that means were significant at 1% level DMRT with coefficient of variation computed at 8.67%. A comparison of means on the different cropping combinations in the CAFÉ site showed no significant difference

3.3 Yield Parameters

3.3.1 Weight of 1,000 seeds

The heaviest weight of seeds was recorded on V_1 at 33.46g followed by V_2 (28.49), V_4 (25.12) and V_3 (24.35). It can be gleaned that the late maturing varieties registered heavier weight of seeds and as compared to the varieties with early maturity. This can be due to the bigger seeds attributed by the mungbeans with later maturity which was also the high yielding. ANOVA revealed that means between the different treatments in the CAFÉ project showed no difference while means between mungbean varieties were significant at 5% level DMRT with coefficient of variation computed at 0.79% and 7.36% respectively. The agronomic characteristics of mungbean permit to fit in various cropping system as intercrop, rotation or relay crop [12].

3.3.2 Seed yield (t/ha)

The seed yield of the late maturing varieties V_1 (876.45) and V_2 (810.20) were higher as compared to the varieties with earlier maturity V_3 (632.70) and V_4 (675.35). The higher yield can be attributed to the more number of pods per plant, longer pod length, more seeds per pod, and heavier weight of seeds of the late maturing varieties. The temperature and humidity in the Philippines is suited for mungbean yields [12]. Although the seed yield was lower compared to the potential yield of the varieties tested (PNS/BAFPS, 2012), it was still considered high owing to the fact that the study was conducted under the partially shaded areas of the CAFÉ Project. The average yield of mungbean is very low not only in India (425 kg/ha) as well as in entire tropical and subtropical Asia [13].

Table 3. Yield parameters of mungbean integrated as cash crop at the CAFÉ Site

Varieties	Weight of 1,000 seeds (g)	Seed Yield (kg/ha)
V1	33.46a	876.45a
V2	28.49b	810.20b
V3	24.35c	632.70d
V4	25.12c	675.35c
c.v. (%)	7.36	3.74
Level of significance	0.05	0.01

4. CONCLUSION

The NSIC Mg 05 – Pag-asa 11 and NSIC Mg 12 – Pag-asa 19 were taller, had more pods per plant, longer pod length, more seeds per pod, heavier seed weight) and higher seed yield as compared to the varieties with NSIC Mg 09 – Pag-asa 15 and NSIC Mg 17 – Pag-asa 17 when integrated as a cash crop on partially shaded areas at the CAFÉ Project site in Conner, Apayao.

5. RECOMMENDATIONS

Based on the foregoing results and conclusion, the following recommendations were forwarded:

1. Planting of mungbean under favorable, partially-shaded, forest-based ecosystem should be promoted to augment the meager income of the upland farmers;
2. Production of IEC materials coming from the CAFÉ Project for the promotion of the generated technology.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Inamul Hasan Madar IH, Amjad Hussain Asangani, Shantkriti Srinivasan, Iftikhar Aslam Tayubi and Gideon I. Ogu¨ Nutritional and Biochemical Alterations in Vigna Radiata (Mung Bean) Seeds by Germination. International Journal of Current Microbiology and Applied Sciences 2017;6(9): 3307-3313. Available:hhttps://doi.org/10.20546/ijcmas.2017.609.408 retrived from http://ijfas.com/wp-content/uploads/2014/08/835-844.pdf
2. Khan S, Khalil SK. Integrated Use of Organic and Inorganic Fertilizers in Wheat and Their Residual Effect on Subsequent Mungbean. International Journal of Farming and Allied Sciences- 2014-3-8/835-844/31; 2014. Available:www.ijfas .com
3. Pinoy Entreprenuer. Mongo (Mungbean) Production; 2015. Available: http://www.pinoy-entrepreneur.com/2010/02/18/mongo-mungbean-production
4. Ali M, Jan I, Ali B, Abbasi KH, Ghani A, Ali S, Khalid M. Influence of Percent Shade And Foliar Application Of Humic Acid On Growth And Development of Gladiolus Grandiflorus. Journal of Pharmaceutical Negative Results. 2022;4948-4957.
5. Zheng E, Zhu Y, Qin M, Chen P, Liu M, Qi Z. Effects of Organic Fertilizer Replacement Nitrogen Fertilizer on Nitrogen Utilization and Growth of Mung Bean: Evidence from 15N-Tracing Technology. Agronomy. 2023;13(1):235.
6. Kumar N, Mrunalini K, Patnaik GP, Behera B. Efficient Diversified Cropping Systems of Field and Horticultural Crops for Livelihood Security. In Integrated Pest Management in Diverse Cropping Systems. Apple Academic Press. 2023;1-29.
7. Gong X, Liu C, Dang K, Wang H, Du W, Qi H, Feng B. Mung bean (*Vigna radiata* L.) source leaf adaptation to shading stress affects not only photosynthetic physiology metabolism but also control of key gene expression. Frontiers in Plant Science. 2022;13:36.
8. Gomez KA, Gomez AA. Statistical Procedures for Agricultural Research. 2nd Edition. John Wiley and Sons, New York, 1984;207- 215.
9. Sarkar MAR, Kabir MH, Begun M, Salam MA. Yield Performance as Affected by Planting Date, Variety and Plant Density. Journal of Agronomy. 2004l3:18-24.
10. Mondal MMA, Puteh AB, Malek MA, Ismail MR, Latif MA. Seed Yield of Mungbean

(*Vigna radiata* (L.) Wilczek) in relation to Growth and Developmental Aspects. The Scientific World Journal; 2012.

11. Brickel C. Encyclopedia of Gardening. Dorling Kindersly Publishers Limited, London. 1992;514.
12. Department of Agriculture. 2021. Investment Guide for Mungbean. Available: https://www.da.gov.ph/wp-content/uploads/2021/04/Investment-Guide-for-Mung-Bean.pdf
13. Chakraborty A, Bordolui SK, Nandi D. Characterization of the green gram (*Vigna radiata* L.) genotypes through both morphological and biochemical parameters. Environment Conservation Journal. 2022;23(3):1-7.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/96405