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AGRONOMIC PERFORMANCE OF MUNGBEAN VARIETIES INOCULATED WITH VARIOUS BENEFICIAL MICROBES

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Article Info

Abstract

A field study was conducted during the summer of 2022 at Agronomy Research Farm, The University of Agriculture Peshawar to evaluate the effects of various beneficial microbes on mungbean varieties. The research comprised of two factors, including mungbean varieties (Ramazan, NIFA mung-19, NIFA mung-17) and beneficial microbes (Brady rhizobium japonicum, Effective Microbes-1, Brady rhizobium japonicum + Effective Microbes-1) in a triplicate randomized complete block design. The study revealed that beneficial microbes did not have a noteworthy impact on mungbean emergence and the timeframe for emergence, although significant effects were noted for other measured parameters. Ramazan variety produced maximum number of pod-1 seeds (11), had highest number of plants at harvest (9 m-2), maximum grain outcome (964 kg ha-1) On the other hand, NIFA Mung-17 produced maximum plant height (93.1 cm), number of pods plant-1 (14.6), thousand grain weight (38.8g), and highest biological yield (3202 kg ha-1). Beneficial microbes significantly influenced most of the parameters studied in all varieties. The mung bean varieties treated with a combination of Brady rhizobium japonicum and effective Microbes-1 exhibited the highest recorded values for plant height (94.6 cm) number of plants at harvest (9 m-2) number of pods plant-1 (15.5), number of seeds per pod1 (12), 1000 grain weight (39.7g), biological output (3230 kg ha-1), grain yield (993 kg ha-1) it is concluded that the application of microbial inoculation, specifically Brady rhizobium + EM-1 produced higher grain yield (993 kg ha-1) followed by Brady rhizobium (953 kg ha-1) while the lowest yield was obtained in control experimental units. Between varieties of mungbean Ramazan produced the highest mungbean yield (964 kg ha-1 followed by NIFA Mung-17 (931kg ha-1). Thus, it is recommended to inoculate Ramazan with Brady rhizobium japonicum + EM-1 for higher yields in the Peshawar valley.

Keywords:
Mungbean, microbes, Plant growth, Seed yield

Introduction

Mungbean (Vigna radiata L.) typically (Achakzai et al., 2012). It is a member of the Fabaceae family and generally recognized as "Mung" or "Mungbean". It is a leguminous crop which can be grown both in spring and kharif seasons. It is an important pulse crop with significant nutritional value. (Kumar et al., 2012). Pulses are commonly known as food legumes, (Kaur et al., 2020). It is a long-cultivated crop that is thought to have originated in India and Southeast Asia, East Africa and Australia (Diatta et al., 2016). Currently, Asia is home to over 90% of the world's mungbean production, India, China, Pakistan, and Thailand are among the leading manufacturers. (Patazek et al., 2018). In Pakistan 183.7 thousand tonnes of mung beans will be produced in 2022–2023 from an area of 213.2 thousand hectares, according to estimates. on having an average yield of approximately 1.29ton ha-1. demonstrating an increase in area and production over the previous targets of 12.58% and 2.29 percent, respectively. (MNFS&R, 2022-23). In KP, the area where the mungbean grew up 0.006 million hectares of land a total output of 0.002 million metric tonnes. In KP, a major portion of the area under mungbean cultivation lies in the Kuram district meaning feel there are a lot of opportunity expanding mungbean area in KP by bringing more area under cultivation in Kuram. (Agric. Statistics of Pak., 2020). Mungbean is regarded as a complete protein and is compatible with cereals as a source of protein (Khan and Malik, 2001), Currently, the Mungbean producing region of the world is about annually six million hectares, with an average yield of 400 kgha-1. (Alene et al., 2020), Mungbean output is quite comparatively modest compared to other developed states due to a variety of restrictions. Among them, appropriate varieties and proper using fertilizer are considered vigorous for Mungbean crop production and growth (Jamro et al., 2018). Mungbean grains nutritionally contain important nutrients protein (24.5%) and carbohydrate (59.9%) with iron (8.5 mg), calcium (75 mg) per 100 g of split dal. Mung beans have also been discovered to be high in antioxidant chemicals and also have numerous beneficial impact on cardiovascular and overall health (Johnson et al., 2020). It ranked second a drought-resistant crop after soybean and can be grown on irrigated as well as arid lands. In leguminous crops, nodules formation occurs that improve soil fertility by fixing 63-342 kg atmospheric N ha in one season (Kaisher et al., 2010). It can be consumed as fodder and also as for the purpose of green manuring. Pakistan is a country where, Mungbean is cultivated as a significant kharif crop (Khattak et al., 2004). The average mungbean production in Pakistan, particularly in KP, low as in comparison to other nations, the causes for this are use of low yielding varieties, no proper inoculation and lack of irrigation facilities etc. Several reports have indicated that good varieties and application of compatible rhizobium species and PGPR considerably promote plant growth and rhizospheric activity, as a result of which there has been a huge increase in legume crop production and productivity. (Zahir et al., 2018). This symbiotic connection with rhizobia bacteria improves biological nitrogen fixation in roots and supplies plants' nitrogen needs (Chatha et al., 2017). It enhances as a result of proper utilization organic manures and chemical fertilisers (Nadeem et al., 2004). It can tolerate only saline condition while it does not perform well in waterlogged soil (Yadave et al., 1998). The adoption of improved varieties is an important indicator of the effectiveness of production. A proper cultivar also has a significant impact on final productivity. Adaptation of high-yielding mungbean with black seeds genotypes to rising circumstances. Thus, varieties would play an important part in enhancing overall production of mungbean in the nation generally, and KP, in particular. (Khattak et al., 2022). The application of bio fertilizers is critical for environmentally friendly farming to use both endophytic actinomycetes and nodule bacteria to boost plant development and productivity. Inoculation of mungbean seeds with various inoculants (Rhizobium, PGPR, effective microbes, brady rhizobium japonicum & PSB) by itself or in combination boosted grain yield and nodulation much more than the vaccine-free control. When sown were treated with Rhizobium, nodulation and grain yield increased. (Htwe et al., 2019). Thus, bearing in mind the importance of varieties and rhizobia species, the current research explored various varieties and rhizobia Mungbean yield components should be improved.

Materials and methods

A field trial was conducted to study the "Agronomic performance of mungbean varieties inoculated with various beneficial microbes" was completed at Agronomy Research Farm, The University of Agriculture Peshawar during summer 2022 in randomized complete block design having three replications and two Factors. Factor A (microbial species) factor B (Mungbean varieties). Basal dose of fertilizer was applied 25: 90: 90 kg ha-1 NPK at the time of sowing. Each subplot's length and width of each subplot were 3 m 1.8 meters respectively, P-P distance and R-R distance 20cm and 30 cm. Sowing was done through seed drill Weeding have done 3 times after one week of sowing than after 4 weeks and 6 weeks of planting. All the required Agronomic practices were used from sowing till harvesting. Brady rhizobium japonicum were collected from NARC, Islamabad and commercially. A mixture made consisting of powdered sterilized mulch, a culture of relevant microorganisms, and sterilized 10% sugar solution was prepared in the ratios of 5:4:1v/v for the inoculation of mung bean seeds (Ahmad et al. 2012). The mung bean seeds were then coated then coated at a rate of 50 ml kg with the slurry, while uninoculated seeds were coated with a similar mixture containing sterile broth without bacteria, serving as control.

Procedure for data collection

Data on the number of plants at harvest was calculated the number of plants in one 1 row at three different places randomly in each plot and then number of plants at harvest were calculated. data on number of pod plant−1 were counted for ten randomly selected plants in each subplot and average was calculated. Number of seed pod−1 was calculated on randomly selected ten pods for each subplot and average per pod will be calculated. Grains weight of randomly 1000 seeds were taken from seed lot of each subplot and was weighed with the help of electronic balance. Data on biological yield was recorded by harvesting the four central rows in each subplot. Then it was sundried to constant weight and it was converted into kg ha-1 with the help of following formula.

$$\text{Biological yield (kg ha}^{-1}\text{)} = \frac{\text{Weight of plant materials in four rows (kg)}}{\text{No of rows x Row length x R-R distance}} \times 10{,}000\ \text{m}^2$$

The four harvested central rows of each treatment after drying were threshed; the seeds were cleaned, weighed and then converted into kg ha-1 with the help of following formula.

$$\text{Grain yield (kg ha}^{-1}\text{)} = \frac{\text{Grain weight of four rows (kg)}}{\text{No of rows x Row length x R-R distance}} \times 10{,}000\ \text{m}^2$$

Statistical Analysis

The collected result was statistically analyzed using randomized complete block design analysis of variance techniques. If the F- values are significant, the means will be compared with the LSD test at 0.05 levels of probability (Jan et al., 2009).

Results and discussion

Number of Plants at Harvest m-2

Table 5. shows data on the number of plants at harvest of mungbean as affected by varieties and different beneficial microbes. Data analysis statistics presented that various mungbean varieties has non- significant while different beneficial microbes and their interactive effect between V×M was found non- significant.

Number of pods plant-1

Mean data regarding number of pods plant-1 of mungbean varieties and different beneficial microbe inoculation and their interaction are presented in Table 6. According to the findings, there is a considerable influence of different beneficial microbe and varieties, while the interaction was discovered to be non-significant. the maximum number of plant-1 pods was achieved by the combined application of Brady rhizobium japonicum +EM-1 (15.5), followed by Brady rhizobium japonicum (14.5), while minimum number of plant-1 pods was noticed by rhizobium EM-1. Amongst varieties NIFA Mung-17 produced maximum number of the pods plant-1 (14.6), followed by NIFA Mung-19 (14.5), while a smaller number of pods plant-1was achieved in Ramazan (12.9). Plant-1 number of pods varieties of mungbean greatly influenced through various rhizobia treatments, but their exchange was observed to be non-significant. The logical reason behind this may be the genetic differences between varieties, as supported by Nair et al. (2019), Dhakal et al. (2020), and Mwangi et al. (2021). These outcomes are consistent with Sharma (2021), who reported that when seed of mung bean was inoculated containing rhizobium bacteria, It raised the quantity of pods plant-1. Moreover, Mat Karimov et al. (2019) revealed that inoculation of seeds with rhizobia increased the quantity that plant-1pods now comparison to the control.

Number of Seeds Pod-1

The sum of seeds pod-1 of mungbean as affected by varieties, and different beneficial microbe inoculation is discussed in Table 7. Mean value of the data revealed significant effect on different beneficial microbe and varieties along with their interaction was also significant. A greater number of seeds pod-1 were observed by combining operation of Brady rhizobium japonicum + EM-1 (12), followed by Brady rhizobium japonicum (11), while a smaller number of seeds pod-1 were observed in Rhizobium EM-1 (10.2). Among varieties Ramazan variety produced a greater no of seeds pod 1 (11), followed by NIFA Mung-19 (11), while lower number of seed pod-1 was noticed for NIFA Mung-19 (10). The results of our study indicated an important difference in the pod-1 number of seeds among mungbean varieties and rhizobia treatments. Furthermore, we found a significant interaction between varieties and rhizobia treatments, which may be credited with genetic differences among the various types. Our outcomes remain validated in Mat Karimov et al. (2019), who stated that rhizobium can rise the quantity of seeds pod-1, and Hettiarachchi1 et al. (2017), informed that rhizobia strain inoculation produced a greater number of seed pod-1.

Table 1. Plant at Harvest, No of Pods Plant-1 and No of Seeds Plant-1 of mungbean varieties as influenced by beneficial microbes.

TREATMENTS	Plant at Harvestm^{-}	No of Pods Plant^{-1}	No of Seeds Plant-^{1}
Varieties			
Ramazan	9	12.9	11
NIFA Mung-19	9	14.5	10
NIFA Mung-17	8	14.6	11
LSD	NS	1	1
Beneficial Microbes			

Control	9	13	10
B. japonicum	9	14	11
EM-1	9	13	10
B. japonicum +EM-1	9	15	12
LSD	NS	1	1
INTERACTION V×M	NS	NS	0.03

Significant differences ($p<0.05$) between means are denoted by different letters within each category using the LSD test.

Thousand seeds weight (g)

The thousand seeds weight of different mungbean varieties was significantly impacted by various beneficial microbe. Similarly, thousand seeds weight of different
for different beneficial microbes are shown in Table 8 the interaction between V × M was noticed non-significant, maximum number of thousand seeds weight was achieved by the application of combine Brady rhizobium sp. + EM-1 (39.7), followed by Brady rhizobium sp. (37.7), while a minimum of thousand seeds weight were observed in control (35.4). Amongst varieties NIFA Mung- 17 produced higher thousand seeds weight (38.8), followed by Ramazan (37.3), while the minimal weight of a thousand seeds was noticed Mung for NIFA -19 (36). Significant impact of different rhizobium analyses for the mungbean grain weight in thousands was observed. However, interaction between them was not significant, which could be due to differences in the varieties, while the difference between inoculated and uninoculated seeds may be attributed to the effect of microbes. Our results are consistent with Bangar et al. (2019), also described statistically significant differences among varieties, similar Zahir et al. (2018), also observed that rhizobium inoculation enhanced thousand grain the mungbean weight, despite this improvement was not significant in most situations.

Biological yield (kg ha-1)

Table 9 showed information on biological yield for different mungbean varieties, rhizobium inoculation. The data revealed the main influence of rhizobium varieties and their interaction. Maximum biological yield was observed by the combined application of Brady rhizobium sp. + EM-1 (3230), followed by EM-1 (3227), while the lowest biological yield was observed inside control plots (2989). Amongst varieties NIFA Mung-17 produced higher biological yield (3202), followed by Ramazan (3132), that was statistically similar in biological yield to NIFA Mung-19 (3048). The study showed significant differences in biological yield among mungbean varieties due to rhizobia treatments, while the interaction between them was discovered to be non-significant. The plant's height was significantly different due to the treatment and varieties in the case for biological yield. These results align with earlier research by Bilal et al. (2021), Khan et al. (2019), and Chattha et al. (2017), biological yield difference which was significantly greater in treated than uninoculated ones.

Grain yield (kg ha-1)

Mean data shown in Table 10 the grain yield of mungbean revealed that, the inoculating rhizobia has a significant impact on grain yield. Furthermore, the interaction between the two factors (V × M) was also found significant. the greatest grain yield was known in the combined operation of Brady rhizobium +

EM-1 (993), followed by Brady rhizobium japonicum. (953), while the control group had the lowest grain yield (794). Regarding the different varieties, Ramazan produced the highest grain yield (964), followed by NIFA Mung-17 (931), while NIFA Mung-19 had the lowest grain yield (856). This study also found that grain yield of different mungbean varieties was greatly influenced by several rhizobium treatments, with the interaction between them also found to be significant. The reason for the difference in grain yield may be due to genetic factors and microbes. Our finings Are similar to Geleta et al. (2022), Alene et al. (2021), Hossain et al. (2014), and Ahmad et al. (2013), who stated that immunization with rhizobium has enhanced grain yield.

Table 2. 1000 grain weight (g), Biological Yield (kg ha-1) and Grain Yield (kg ha-1) of mungbean varieties as influenced by beneficial microbes.

TREATMENTS	1000 grain weight (g)	Biological Yield (kg ha^{-1})	Grain Yield (kg ha^{-1})
Varieties			
Ramazan	37.3	3132	964
NIFA Mung-19	36.1	3048	856
NIFA Mung-17	38.8	3202	931
LSD	1.55	128.64	38
Beneficial Microbes			
Control	35.4	2989	794
B. Japonicum	37.7	3063	953
EM-1	36.9	3227	927
B. Japonicum +EM-1	39.7	3230	993
LSD	1.79	111.40	45
INTERACTION V×M	NS	NS	2.16

Significant differences ($p<0.05$) between means are denoted by different letters within each category using the LSD test.

Conclusion

Microbial inoculation i.e. Brady rhizobium +EM-1 produced higher grain yield (993 kg ha-1) followed by Brady rhizobium (953 kg ha-1) however, the lowest yield was obtained in control experimental units. Amongst varieties of mungbean variety Ramazan produced highest mungbean yield (964 kg ha-1) followed by NIFA Mung-17 (931 kg ha-1). Therefore, it is recommended to inoculate mungbean variety Ramazan with Brady rhizobium japonicum + EM-1 for increased yield components and yield components in the valley of Peshawar, Pakistan.

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