Effect of Different Phosphorus levels and Mulch typeson Growth and Yield of Mung bean

Abstract

A field experiment was conducted at experimental farm, Department of Agronomy, Facultyof Agriculture and Veterinary Sciences, Mewar University Gangrar, Chittorgarh (Rajasthan)duringRabiseasonof2022-23to effectofdifferent nutrient management practicesongrowth and yield of mung beanvariety "SML-832" wasused in this study. The required quantities of nutrient as per treatments were applied. Theexperiment was laid out in randomized complete block design with four replications combinationsfour phosphorus levels *i.e.*P_0-Control- critical growth stages,P_1-20 kg P_2O_5, P_2-30 kg P_2O_5andP_3-40 kg $P_2O_5$and mulch types *i.e.*M_0-Control (No Mulch), M_1-Organic Mulch i.e. Bajra Bhusa @ 5t ha^{-1}, M_2-Black Polythene Sheet and M_3-Silver Colour Sheet.The increased growth attributes (Plant height, number of root nodules per plant, weight of nodules per plant and dry weight per plant), and yield parameter such as (Number of pods per plant, number of seed per pod, seed yield and stover yield was recorded treatment with P_2 (30 kg P_2O_5) and M_1-Organic Mulch i.e. Bajra Bhusa @ 5t ha^{-1}.

Keywords: -Mulch.;Phosphorus;Mung bean;Yield

1. Introduction

Pulses are a staple food around the world, playing a key role in many traditional cuisines. In India, it is an important group of food crops that can play a vital role to address national food and nutritional security and also tackle environmental challenges. The leguminous grain crop known as "green gram," or botanically known as *Vigna radiata*, is noted for its great flexibility and minimal input requirements. India is one of the important mung bean growing countries in Asia with an area 8.7 million hectares and production of 8.83 million tonnes with a productivity of 1014 kg ha^{-1} (Anonymous., 2020).

The most crucial ingredient for grain legumes is phosphorus, which is also an essential component of protein and nucleic acid and aids in the digestion of nitrogen. The most significant single factor affecting the quality and production of mung beans is deficiency, which is caused by its high fixation capacity and poor mobility. Legumes need more phosphorus for growth, nodulation, and nitrogen fixation than other plants do. This

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nutritional element has long been understood to be a necessary component of all living things and to be crucial for energy transmission and conservation in living cells' metabolic energy reactions, which include biological energy transformations. The phosphorus affects a number of biological processes, including membrane transport, cytoplasmic streaming, protein and phospholipid formation, nucleic acid synthesis, and photosynthesis.

Utilizing stored water effectively can result in increased productivity by using various management techniques. Mulching the soil to conserve water could also increase crop yields. Straw mulch improves grain output and water use efficiency by drastically lowering evaporation loss. However, the effects of straw mulch on mung bean yield have varied, primarily because of variations in meteorological circumstances.

Mulch also enhanced roots by changing the soil's hydrothermal regime. Improved roots facilitate the crop's ability to more effectively draw water from the soil, which results in a favorable plant water status (as indicated by the temperature of the canopy). Mulches work best at preserving water in the wet range in conditions when evaporation is steady and regulated by atmospheric demand. Mulching has been emphasized by a number of researchers as a way to conserve soil water and increase crop output (Sharma *et al.*, 1990).

2. MaterialsandMethods

A field experiment was conducted during Rabi season of 2022-23at experimentalfarm, Department of Agronomy, Faculty of Agriculture and Veterinary Sciences, MewarUniversity Gangrar, Chittorgarh (Rajasthan). Soil of the experimental field was sandy loam intexture, saline in reaction with a pH value of 7.6, poor in organic carbon (0.16%), deficient inavailable zinc (0.48 ppm) and iron (1.2 ppm) low in available nitrogen (176 kg/ha) andphosphorus (20.2 kg/ha) but medium in available potassium (320 kg/ha). The experiment waslaid out in randomized complete block design with four replications. The required quantities of nutrients as per treatments were applied. The doses ofphosphoruswereappliedintheformofsingle super phosphate. The growth and yield parameters was recorded as per standard calculations.

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3. ResultsandDiscussion

Growth attributes

The application of different phosphorus levels and mulch types have a noticeably significantly impact on plant height, number of nodules per plant, weight of nodules per plant

and dry weight per plant. The information shown in Table 1 and Figure 1 to 2 demonstrates how various phosphorus levels and mulch types have an influence on the growth attributes of mung bean.

Data presented in Table 1and figure 1 indicated that differences in plant height due to different phosphorus levels and mulch types were significant. Treatment P_2 (30 kg P_2O_5) recorded significantly the highest plant height (26.11, 38.89 and 50.50 cm). The minimum plant height was recorded (22.64, 30.69 and 42.43 cm) at 20, 50 DAS and harvest stages, respectively.Treatment M_1-Organic Mulch i.e. Bajra Bhusa @ 5t ha^{-1} recorded significantly the highest plant height (25.08, 35.31 and 47.38 cm). The minimum plant height was recorded (21.90, 31.48 and 43.43 cm) at 20, 50 DAS and harvest stages, respectively. Similar result also reported by Trivedi*etal*(2013) and Chakraborty*etal*.(2016).

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Data presented in Table .1 and figure 2 indicated that differences in number of root nodules per plant due to different phosphorus levels and mulch types were significant. Treatment P_2 (30 kg P_2O_5) recorded significantly the highest number of root nodules per plant (38.95). The minimum number of root nodules per plant was recorded (35.18).Treatment M_1-Organic Mulch i.e. Bajra Bhusa @ 5t ha^{-1} recorded significantly the highest number of root nodules per plant (38.00). The minimum number of root nodules per plant was recorded (35.87).

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Data presented in Table .1 and figure 2 indicated that differences in weight of nodules per plant due to different phosphorus levels and mulch types were significant. Treatment P_2 (30 kg P_2O_5) recorded significantly the highest weight of nodules per plant (44.45 mg/plant). The minimum weight of nodules per plant was recorded (36.85 mg/plant).Treatment M_2-Black Polythene Sheet recorded significantly the highest weight of nodules per plant (45.66 mg/plant). The minimum weight of nodules per plant was recorded (38.90 mg/plant). Similar concluded byMitra *et al* (2017) and Sekhon*et al.*(2017).

Data presented in Table .1 and Figure 2 indicated that differences in dry matter accumulation due to different phosphorus levels and mulch types were significant. Treatment P_2 (30 kg P_2O_5) recorded significantly the highest dry matter accumulation (15.85 g). The minimum dry matter accumulation was recorded (8.36 g).Treatment M_2-Black Polythene Sheet recorded significantly the highest dry matter accumulation (14.66 g). The minimum dry matter accumulation was recorded (8.25 g).This finding also supported byBunkar*etal*(2020), Chavan *et al.* (2020) and Choudharyet*al* (2021).

Yieldattributes

The application of different phosphorus levels and mulch types have a noticeably significantly impact on pods per plant, number of seed per pod, seed yield and stover yield. The information shown in Table 2 and Figure 2 demonstrates how various phosphorus levels and mulch types have an influence on the yield attributes and yield of mung bean.

Data presented in Table 2 indicated that differences in number of pods per plantdue to different phosphorus levels were significant. Treatment P_2 (30 kg P_2O_5) recorded significantly the maximum number of pods per plant (30.68). The minimum number of pods per plant was recorded (26.51).Treatment M_1-Organic Mulch i.e. Bajra Bhusa @ 5t ha^{-1} recorded significantly the maximum number of pods per plant (30.28), closely. The minimum number of pods per plant was recorded (25.75). Same result recorded byGupta and Rao (2015), Singh *et al.* (2015) and Khan *et al.* (2017).

Data presented in Table 2 indicated that differences in number of seeds per pod due to different phosphorus levels were significant. Treatment P_2 (30 kg P_2O_5) recorded significantly the maximum number of seeds per pod (9.55). The minimum number of seeds per pod was recorded (6.02).Treatment M_1-Organic Mulch i.e. Bajra Bhusa @ 5t ha^{-1} recorded significantly the maximum number of seeds per pod (9.20). The minimum number of seeds per pod was recorded (6.05).

Data presented in Table 2 and Figure 2 indicated that differences in seed yield due to different phosphorus levels were significant. Treatment P_2 (30 kg P_2O_5) recorded significantly the maximum seed yield (1234.03 kg/ha). The minimum seed yield was recorded (585.42 kg/ha).Treatment M_1-Organic Mulch i.e. Bajra Bhusa @ 5t ha^{-1} recorded significantly the maximum seed yield (1128.47 kg/ha). The minimum seed yield was recorded (795.83 kg/ha). These data also supported by Imran*et al.* (2016) and Jahish*et al.* (2017)

Data presented in Table 2 and Figure 2 indicated that differences in straw yield due to different phosphorus levels were significant. Treatment P_2 (30 kg P_2O_5) recorded significantly the maximum straw yield (2303.47 kg/ha). The minimum straw yield was recorded (1714.58 kg/ha).Treatment M_1-Organic Mulch i.e. Bajra Bhusa @ 5t ha^{-1} recorded significantly the maximum straw yield (2076.36 kg/ha). The minimum straw yield was recorded (1767.36 kg/ha). Similar results also concluded by Singh *et al.* (2015), Ram *et al* (2021) and Singh *et al* (2021).

Conclusion

On the basis of one-year experimentation it is advisable to apply (30 kg P_2O_5 kg/ha) with the application of organic mulch *i.e.*Bajra Bhusa @ 5 t ha^{-1} for securing higher seed

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yield and maximum production.

Table 1 Influence of different phosphorus levels and mulches type on growth attributes of mung bean

Treatment	Periodical plant height (cm)			Number of nodules per plant at 60 DAS	Weight of nodules (mg/plant) at 45 DAS	Dry matter accumulation (g) at harvest
	20 DAS	50 DAS	At harvest			
Main plot treatment: Phosphorus (P)						
P_0-Control- critical growth stages	22.64	30.69	42.43	35.18	36.85	8.36
P_1-20 kg P_2O_5	23.20	31.3	43.86	36.54	40.28	12.45
P_2-30 kg P_2O_5	26.11	38.89	50.5	38.95	44.45	15.85
P_3-40 kg P_2O_5	23.48	33.32	45.91	36.81	42.82	13.45
S.Em. ±	0.77	0.88	1.02	0.72	1.01	0.98
C D. (5 %)	2.32	2.65	3.08	2.26	3.04	2.95
C.V. %	12.86	10.53	8.9	7.8	9.45	10.45
Sub plot treatment: Mulches (M)						
M_0-Control (No Mulch)	21.9	31.48	43.43	35.87	38.90	8.25
M_1-Organic Mulch i.e. Bajra Bhusa @ 5t ha^{-1}	25.08	35.31	47.38	38	40.27	9.68
M_2-Black Polythene Sheet	24.28	33.99	46.30	36	45.66	14.66
M_3-Silver Colour Sheet	24.10	33.42	45.26	37.20	44.45	12.85
S.Em. ±	0.77	0.88	1.02	0.70	1.07	0.98
C D. (5 %)	2.32	2.65	3.09	2.11	3.22	2.95
Interaction (P x M)						
S.Em. ±	1.05	1.27	1.89	1.32	2.25	2.10
C D. (5 %)	NS	NS	NS	NS	NS	NS
C.V. %	8.81	7.52	8.27	7.13	10.60	8.58

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Table 2 Influence of different phosphorus levels and mulches type on yield attributes and yield of mung bean

Treatment	Number of pods per plant at harvest	Number of seeds per pod	Seed yield(kg ha^{-1})	Straw yield (kg ha^{-1})
Main plot treatment: Phosphorus (P)				
P_0-Control- critical growth stages	26.51	6.02	585.42	1714.58
P_1-20 kg P_2O_5	26.81	6.85	916.67	1756.94
P_2-30 kg P_2O_5	30.68	9.55	1234.03	2303.47
P_3-40 kg P_2O_5	27.64	8.98	1115.28	1978.47
S.Em. ±	0.81	0.19	48.51	60.93
C D. (5 %)	2.42	0.57	155.18	184.69
C.V. %	11.66	7.69	10.15	8.76
Sub plot treatment: Mulches (M)				
M_0-Control (No Mulch)	25.75	6.05	585.42	1767.36
M_1-Organic Mulch i.e. Bajra Bhusa @ 5t ha^{-1}	30.28	9.20	916.67	2076.36
M_2-Black Polythene Sheet	27.89	8.02	1234.03	1993.75
M_3-Silver Colour Sheet	27.73	7.66	1115.28	1915.97
S.Em. ±	0.81	0.39	48.51	60.65
C D. (5 %)	2.42	6.88	155.18	182.58
Interaction (P x M)				
S.Em. ±	1,36	0.66	81.48	127.2
C D. (5 %)	NS	NS	NS	NS
C.V. %	9.73	7.02	9.92	11.12

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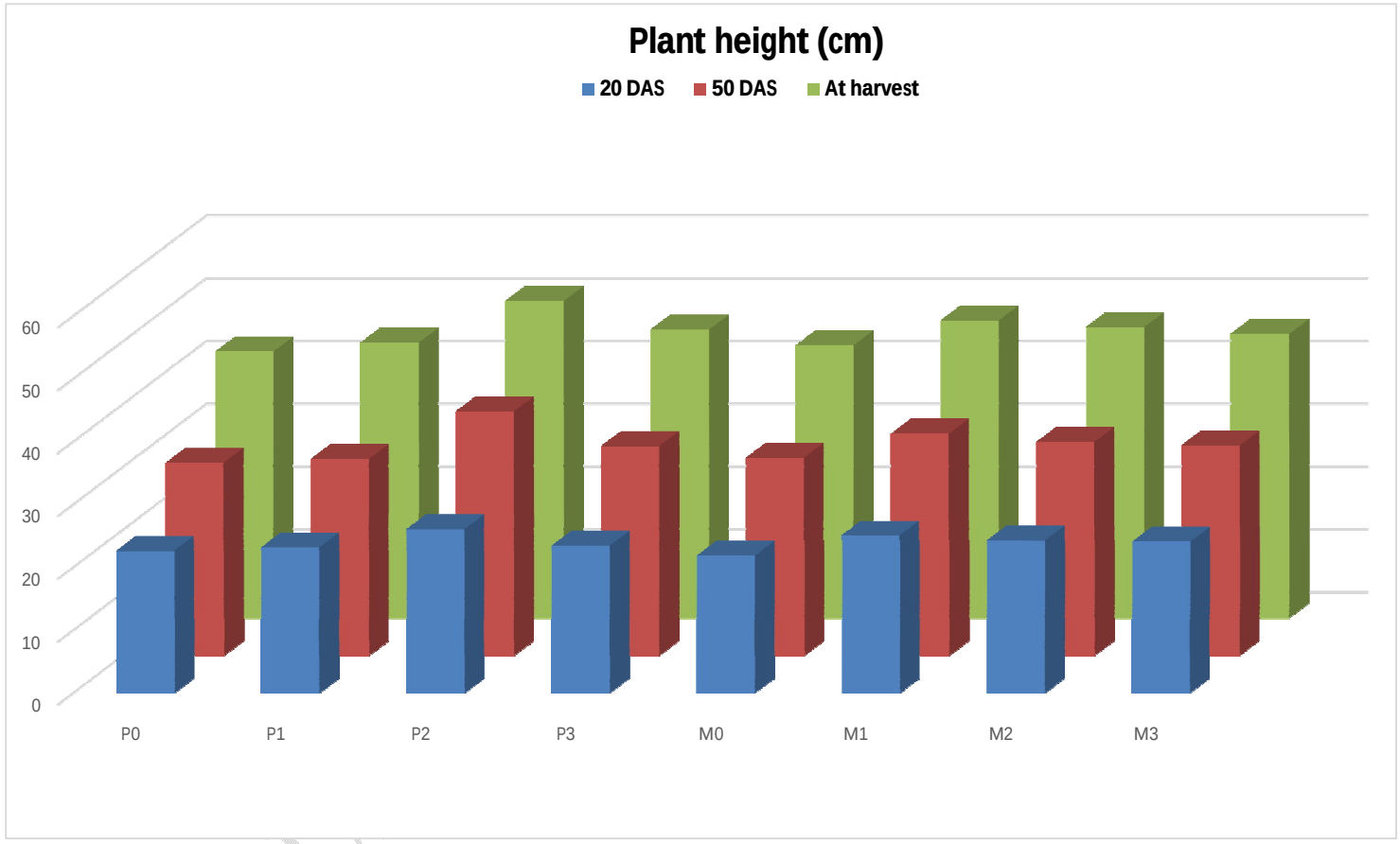

Figure 1 Influence of different phosphorus levels and mulches type on plant height of mung bean

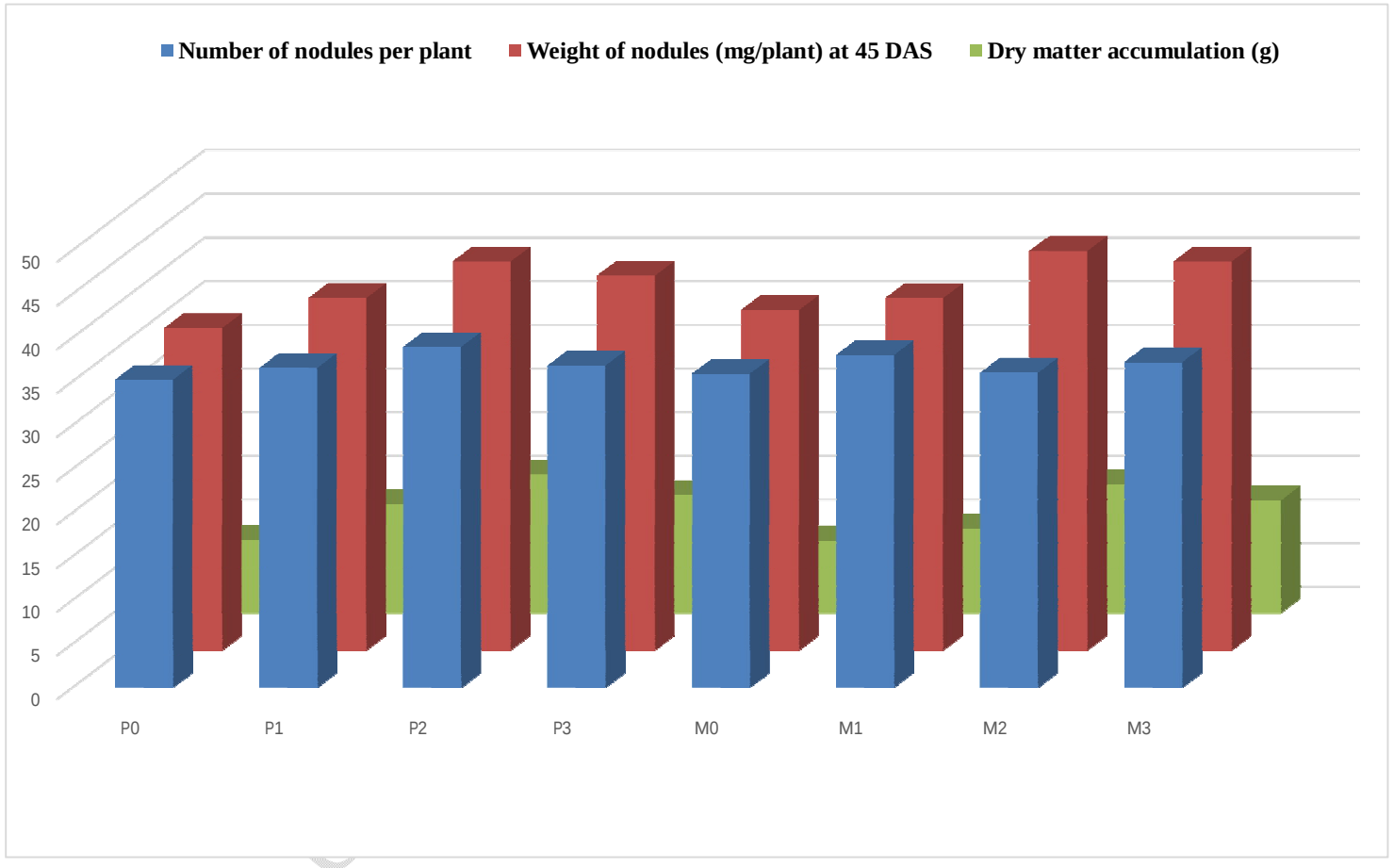

Figure2 Influence of different phosphorus levels and mulches type on growth attributes of mung bean

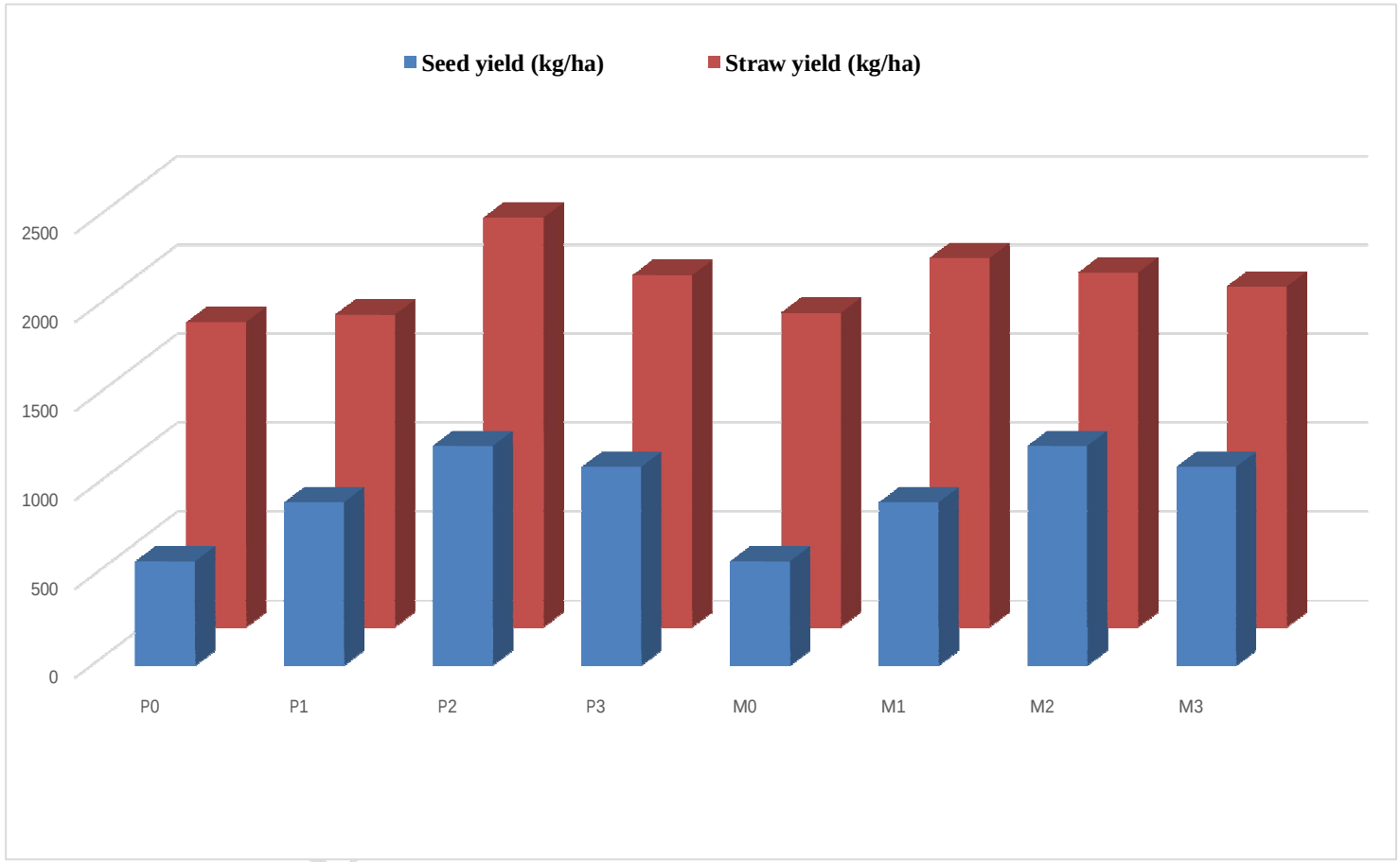

Figure3 Influence of different phosphorus levels and mulches type on yield of mung bean

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