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RESEARCH ARTICLE

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH ATTRIBUTES AND SEED YIELD IN MUNGBEAN

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Abstract

A field experiment entitled**"Integrated Nutrient Management on Summer Mung bean (Vigna radiata)"** under Malwa Region was conducted during summer season2021and2022at the field of Agronomy, SAGE University, Indore. There were nine treatment combinations of integrated nutrient management i.e. T1: Control, T2: RDF (20 kg N + 40 kg P2O5/ha), T3: RDF + Rhizobium + PSB, T4: FYM (10 Kg/Ha), T5: FYM + Rh + PSB, T6: RDF (50%) + FYM (2.5 t/ha) + (Rh+ PSB), T7: RDF (50%) + FYM (5 t/ha) + (Rh+ PSB), T8: RDF (25%) + FYM (5 t/ha) + (Rh+ PSB) and T9: RDF (75%) + FYM (5 t/ha) + (Rh+ PSB) with four replications under Randomized Block Design. Based on two years experimental finding on mungbean under the influence of integrated nutrient management during the both seasons i.e., 2021 and 2022 with pooled, it appeared that conjoint application of T9 treatment combination RDF (75%) + FYM (5t/ha) + (Rh + PSB) resulted in significantly superior in plant height, plant dry matter accumulation (gram per meter row length), number of branches ($plant^{-1}$), chlorophyll content in leaves (mg/g fresh weight of leaves), total number of root nodules ($plant^{-1}$), effective number of root nodules ($plant^{-1}$), fresh weight of root nodules ($plant^{-1}$), and dry weight of root nodules ($plant^{-1}$), various yield and yield attributing characteristics viz., number of pods (plant $^{-1}$), number of seeds (Pod $^{-1}$), test weight (1000 seed weight in grams), seed yield (Kg ha $^{-1}$), straw yield (Kg ha $^{-1}$), biological yield (Kg ha $^{-1}$), harvest index (%), protein content (%) in seed, protein yield (Kg ha $^{-1}$) by seed, nutrient content, nutrient uptake, cost of cultivation (Rs. ha^{-1}), gross return (Rs. ha^{-1}), net return (Rs. ha^{-1}) and B:C ratio.

Introduction:-

Mung bean [Vigna transmit (L.) Wilczek] has been filled in India since antiquated times. It is one of the significant heartbeat harvests of India and is become under sole, blended and numerous trimming frameworks during stormy (kharif), spring and summer seasons under extensive variety of agro-climatic circumstances [1]. In business farming, the utilization of large-scale supplement manures can't be precluded totally come about soil is eager. In any case, there is a requirement for bioinorganic mixes of substitute wellsprings of supplements for supporting soil wellbeing and harvest efficiency [2]. In bioinorganic mixes Rhizobium, phosphorus solubilizing microscopic organisms (PSB)

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and vermicompost are significant parts. Vermicompost has been found to have valuable impacts when utilized as an aggregate or halfway substitute for mineral manure and as soil revisions in field studies. Moreover, some concentrates on show that vermicomposting leachates or vermicompost water-removes, utilized as substrate corrections, additionally advance the development and yield boundaries of harvests [3]. Further, bio-manures are minimal expense and eco-accommodating information have gigantic capability of providing supplements which can decrease the synthetic compost portion by 24-45% [4]. Nitrogen and phosphorus are thesignificant supplements which assume a significant part in crop creation. The nitrogen perceived as head boss to the treatment program for higher yield. Phosphorus expands the root proficiency which thus further develops dampness and supplementuse under rainfed conditions. For expandedsupplement supply through bio-manures, there is aneed for working on the effectiveness of organicnitrogen-obsession framework. Phosphorus-solubilizingmicroorganisms are likewise answered to be helpful inexpanding the phosphorus accessibility in soil andin this way seed yield of mungbean. Consequently, there isa need to apply vermicompost to get to the next levelnourishing climate of the dirt. Nonetheless,small data is accessible on the consolidatedimpact of vermicompost, Rhizobium andphosphorus solubilizing microorganisms (PSB)vaccination alongside manure supplements inmungbean for keeping up with soil wellbeing and highercrop efficiency [5]. The fundamental goal of thisstudy was to assess the impact of bioinorganicblends ondevelopment, yield, supplementboundaries and financial matters of mung bean.

Micronutrients are exceptionally fundamental for the appropriate development and improvement of any yield and both quantitative (seed yield) as well as subjective (wholesome quality) characters are profoundly affected by soil's micronutrient status (Babaeian et al. 2011, Meena et al. 2013) [6]. In India, most vegetable yields incorporating mungbean are developed in less ripe, poor, and negligible soils, furthermore, also low stockpile of natural and inorganic every now and again influences the last yield (Kumawat et al., 2010) [7]. Likewise, the development of yields on tricky soils, for example, acidic andsoluble soils is assessed to influence over half of the world's yield potential.

Then again, overabundance and inappropriate utilization of inorganic manures without information on coordinated supplement the board further irritates the lower creation and furthermore radically influences the solid soil climate (Bradl 2004)[8].

Lately, various methodologies have been drilled tosupport agribusiness creation and among them, coordinated useof accessible supplement assets is the most encouraging methodology.The fair utilization of supplements alongside productive harvest, water,soil, and land the board will be essential for agribusiness in thecoming days. By keeping in view the changing environmentsituation, a coordinated methodology of supplement application alongwith biofertilizers and fertilizers not just guarantees further developed soilwellbeing and yet in addition supports crop efficiency (Babulkar, 2000)[9].

Material and Methods:-

The Treatment details are as follows:

The experiment was laid out in a randomized block design with seven treatments and three replication viz. T1 (Control), T2 (RDF (20 kg N + 40 kg P2O5/ha), T3 (RDF + Rhizobium PSB), T4 (FYM (10 Kg/Ha), T5 (FYM(Rh+ PSB)), T6 (RDF (50%) + FYM (2.5 t/ha) + (Rh+ PSB) ,T7 (RDF (50%) + FYM(5 t/ha) + (Rh+ PSB), T8 (RDF (25%) + FYM(5 t/ha) + (Rh+ PSB) and T9 (RDF (75%) + FYM (5 t/ha)+(Rh+ PSB),(Nitrogen, phosphorus and Potassium were applied as per treatment, half dose of nitrogen, full dose of phosphorus and potassium were applied at time of sowing and rest dose of nitrogen in two equal split one at 45 and 2nd at 60 days after sowing. FYM and vermicompost were applied before 15 days of sowing. Seed treatment was done with PSB + Rhizobium (bio-fertilizer).

Results:-

The effect of different treatment combinations of integrated nutrient management practices on mungbean growth parameters such as plant population (per meter row length), plant height, dry matter accumulation (per 0.5 sq. Meter row length), and chlorophyll content, were found to be significant. Data from studies reveals that T_9 treatment combination with the application of RDF (75%) + FYM (5 t/ha) + (Rh+ PSB) significantly increased the growth parameters at different growing interval i.e., 20 DAS, 50 DAS and at harvest compared to control and other treatments. The combined application of organic, inorganic and bio-fertilizer boosted the availability of major nutrients to plants, enhanced cell multiplication and early root growth. That led to higher absorption of nutrients

from deeper layers of soil and ultimately resulted in increased plant growth. The ability of plants to grow taller could be due to readily available nitrogen, which is a key component of protoplasm and aids in photosynthesis as well as speeds up metabolism, cell division, and cell elongation. The higher availability of nitrogen helps in production of auxin that increases the number of branches per plant. The better emergence, stronger root system and faster plant growth could be factors in increased leaf area index. Increase in total dry matter towards maturity may be due to growth pattern, higher rate of CO_2 fixation and RuBP carboxylase activity during crop growth.

Plant Population

Effect of integrated nutrient management on plant population of mungbean data per meter row length at 20 DAS, 50 DAS and at Harvest both the year i.e. Summer Season 2021 and 2022 has been summarized in Table 4.1.1, Where it is appraised that the experimental variable did not altogether influence the plant population. Pooled Result presented in Table 4.1.1 showed that the plant populations were identical for all practical purposes under different integrated nutritional management treatments. At 20 DAS, plant per meter row length ranges from 10.39 plants/m to 11.18 plants/m. At 50 DAS, plants per meter row length varied from 9.34 plants/m to 11.17 plants/m and at harvest, it ranged from 9.08 plants/m to 10.25 plants/m. From the calculations of these plants, sowing was done properly and evenly using healthy and effective seeds of Samrat (PDM - 139) variety for good seed germination and emergence. Secondly, plant count at maturity stage indicated that climatic conditions such as maximum and minimum temperatures, relative humidity, and rainfall have no unfavorable impact on crops. Similar findings were also observed by Dey, et. al., 2022.

Table 4.1.1:- Effect of Integrated Nutrient Management on Plant Height of Mung bean at 20 DAS,50 DAS and At Harvest of Mung bean during Summer.

Treatments	Plant Population (Plants per 0.5 sq. meter row length) at 20 DAS			Plant Population (Plants per 0.5 sq. meter row length) at 50 DAS			Plant population (Plants per 0.5 sq. Meter row length) at harvest		
	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled
T_1: Control	11.05	11.13	11.09	11.05	11.30	11.17	10.05	10.46	10.25
T_2: RDF (20 kg N + 40 kg P2O5/ha)	10.26	10.51	10.39	10.00	10.25	10.13	9.58	9.74	9.66
T_3: RDF + Rhizobium + PSB	12.00	10.00	11.00	9.98	10.00	9.99	10.01	10.19	10.10
T_4: FYM (10 Kg/Ha)	11.00	11.00	11.00	11.00	10.76	10.88	9.67	9.85	9.76
T_5: FYM + Rh + PSB	11.00	10.00	10.50	10.00	9.67	9.84	9.67	9.80	9.74
T_6: RDF (50%) + FYM (2.5 t/ha) + (Rh+ PSB)	11.00	10.92	10.96	9.67	9.00	9.34	9.00	9.17	9.08
T_7: RDF (50%) + FYM (5 t/ha) + (Rh+ PSB)	12.00	10.06	11.03	10.00	9.67	9.84	9.67	9.75	9.71
T_8: RDF (25%) + FYM (5 t/ha) + (Rh+ PSB)	11.00	11.36	11.18	9.67	9.33	9.50	9.33	9.47	9.40
T_9: RDF (75%) + FYM (5 t/ha) + (Rh+ PSB)	11.00	10.00	10.50	10.00	9.67	9.84	9.79	9.94	9.87
SEm±	**0.58**	**0.75**	**0.45**	**0.80**	**0.60**	**0.46**	**0.70**	**0.56**	**0.41**
CD at 5 %	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Plant Height

Data presented in Table 4.1.2 pertaining to plant height (cm) at 20 DAS was significantly influenced by the different levels of treatment on integrated nutrient management practices. Table 4.1.2 shows the data and states that plant height, in general, was multiplied by the progress of plant growth up to the stage of 20 DAS under all the treatments during summer season of the year 2021 and 2022. During both the years and pooled data explicit that maximum plant height (20.69, 20.97 and 20.83, respectively) was recorded under T9 treatment combination i.e., RDF (75%) + FYM (5t/ha) + (Rh + PSB) which was significantly at par with T7 treatment: RDF (25%) + FYM (5t/ha) + (Rh + PSB) and T8 treatment: RDF (50%) + FYM (5t/ha) + (Rh + PSB).

At the stage of 50 DAS under all the treatments during summer season of the year 2020-21 and 2021-22 and pooled data explained that highest plant height (39.61, 40.56 and 40.09, respectively) was recorded under T9 treatment

combination i.e., RDF (75%) + FYM (5t/ha) + (Rh + PSB) which was significantly at par and followed by T8 treatment combination (38.56, 39.50 and 39.03, respectively): RDF (50%) + FYM (5t/ha) + (Rh + PSB) and T7 treatment combination (37.57, 38.50 and 38.03, respectively): RDF (25%) + FYM (5t/ha) + (Rh + PSB).

Same as at stage of harvest, during both the years and pooled data explained that highest plant height (52.27, 52.87 and 52.57, respectively) was recorded under T9 treatment combination i.e., RDF (75%) + FYM (5t/ha) + (Rh + PSB) and lowest plant height was observed under T1: Control i.e., 31.05, 31.13 and 31.09, respectively. Highest plant height under T9 treatment which was significantly at par by T8 treatment combination (51.06, 51.65 and 51.35, respectively): RDF (50%) + FYM (5t/ha) + (Rh + PSB) and T7 treatment combination (49.92, 50.49 and 50.21, respectively): RDF (25%) + FYM (5t/ha) + (Rh + PSB). However, under the period of investigation, these three treatment combinations i.e., T9, T8 and T7 were recorded at remarkably higher plant height over the rest of the treatment combinations.

Table 4.1.2:- Effect of Integrated Nutrient Management on Plant Height of Mung bean at 20 DAS,50 DAS and At Harvest of Mung bean during Summer.

Treatments	Plant Height at 20 DAS			Plant Height at 50 DAS			Plant Height at harvest		
	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled
T_1: Control	11.80	12.13	11.96	27.14	27.50	27.32	31.05	31.13	31.09
T_2: RDF (20 kg N + 40 kg P2O5/ha)	14.88	15.09	14.98	32.37	33.24	32.81	43.94	44.44	44.19
T_3: RDF + Rhizobium + PSB	16.72	16.94	16.83	34.66	35.55	35.11	46.57	47.11	46.84
T_4: FYM (10 Kg/Ha)	17.53	17.76	17.65	35.68	36.58	36.13	47.74	48.29	48.01
T_5: FYM + Rh + PSB	17.86	18.09	17.98	36.09	36.99	36.54	48.21	48.76	48.49
T_6: RDF (50%) + FYM (2.5 t/ha) + (Rh+ PSB)	15.21	15.42	15.31	32.78	33.65	33.22	44.41	44.92	44.66
T_7: RDF (50%) + FYM (5 t/ha) + (Rh+ PSB)	19.08	19.29	19.18	37.57	38.50	38.03	49.92	50.49	50.21
T_8: RDF (25%) + FYM (5 t/ha) + (Rh+ PSB)	19.85	20.10	19.97	38.56	39.50	39.03	51.06	51.65	51.35
T_9: RDF (75%) + FYM (5 t/ha) + (Rh+ PSB)	20.69	20.97	20.83	39.61	40.56	40.09	52.27	52.87	52.57
SEm±	**0.62**	**0.64**	**0.42**	**0.44**	**0.77**	**0.43**	**0.67**	**0.61**	**0.42**
CD at 5 %	**1.80**	**1.87**	**1.19**	**1.29**	**2.24**	**1.22**	**1.96**	**1.77**	**1.20**

Plant Dry Matter Accumulation (gram per 0.5 sq. meter row length)

Table 4.1.3 shows the data and states that plant dry matter of summer mung bean was exceedingly increased by the progress of plant growth up to the stage of 20 DAS under all the treatments during summer season of the year 2021 and 2022. During both the years and pooled data explained that maximum plant dry matter was recorded under T9: RDF (75%) + FYM (5t/ha) + (Rh + PSB) treatment combination i.e., 25.94, 26.93 and 26.44, respectively and lowest was observed under T1: Control i.e., 11.05, 11.13 and 11.09, respectively. However, under the period of investigation, four treatment combinations i.eT9, T8, T7 and T6 were recorded with remarkably higher plant dry matter accumulation (gram per 0.5 sq. meter row length) over the rest of the treatment combinations.

At 50 DAS interval data reveals that the plot receiving T9: RDF (75%) + FYM (5t/ha) + (Rh + PSB) treatment combination registered significantly more dry weight of plant in per meter row length i.e., 57.66, 60.16 and 58.91 in summer mung bean during the summer season of 2020-21, 2021-22 and pooled, respectively followed by the application of T8, T7 and T6 treatment combinations, the significantly lowest plant dry matter per 0.5 sq. meter row length.

At last at harvest stage the data indicates that the plot receiving T9: RDF (75%) + FYM (5t/ha) + (Rh + PSB) treatment combination registered remarkably higher dry weight of plant in per 0.5 sq. meter row length i.e., 86.26, 89.31 and 87.79 in mungbean during the summer season of the year 2021, 2022 and pooled, respectively followed by the application of T8: RDF (50%) + FYM (5t/ha) + (Rh + PSB) treatment combinations, the significantly lowest

plant dry matter per meter row length i.e., 67.00, 67.75 and 67.38 was recorded in mungbean during the both summer season i.e., 2020-21, 2021-22 and pooled, respectively.

Table 4.1.3:- Effect of Integrated Nutrient Management on Plant Dry Matter Accumulation (gram per 0.5 sq. meter row length) of Mung bean at 20 DAS,50 DAS and At Harvest of Mung bean during Summer.

Treatments	At 20 DAS			At 50 DAS			At harvest		
	2021	2022	Pooled	2021	2022	Pooled	2021	2022	Pooled
T_1: Control	11.05	11.13	11.09	42.25	44.25	43.25	67.00	67.75	67.38
T_2: RDF (20 kg N + 40 kg P2O5/ha)	18.22	19.12	18.67	46.35	48.71	47.53	70.60	73.45	72.02
T_3: RDF + Rhizobium + PSB	19.66	20.58	20.12	48.46	50.85	49.66	73.53	76.42	74.97
T_4: FYM (10 Kg/Ha)	21.98	22.92	22.45	51.86	54.28	53.07	78.23	81.18	79.70
T_5: FYM + Rh + PSB	22.97	23.93	23.45	53.31	55.75	54.53	80.24	83.21	81.72
T_6: RDF (50%) + FYM (2.5 t/ha) + (Rh+ PSB)	23.76	24.73	24.24	54.47	56.93	55.70	81.84	84.84	83.34
T_7: RDF (50%) + FYM (5 t/ha) + (Rh+ PSB)	23.96	24.93	24.44	54.76	57.22	55.99	82.25	85.24	83.75
T_8: RDF (25%) + FYM (5 t/ha) + (Rh+ PSB)	24.46	25.43	24.94	55.48	57.95	56.72	83.25	86.26	84.76
T_9: RDF (75%) + FYM (5 t/ha) + (Rh+ PSB)	25.94	26.93	26.44	57.66	60.16	58.91	86.26	89.31	87.79
SEm±	**0.59**	**0.54**	**0.37**	**0.64**	**0.78**	**0.48**	**0.79**	**1.16**	**0.67**
CD at 5 %	**1.73**	**1.57**	**1.06**	**1.86**	**2.28**	**1.36**	**2.30**	**3.40**	**1.92**

Chlorophyll Content in Leaves (mg/g fresh weight of leaves)

It is clear from the data presented in Table 4.1.4 states that there was significant difference in chlorophyll content in fresh leaves (mg/g fresh weight of leaves) of mungbean at 40 DAS during the summer season of the year 2021 and 2022 and pooled under different treatment combinations on integrated nutrient management practices. Application of RDF (75%) + FYM (5t/ha) + (Rh + PSB) under T9 resulted in remarkable content of chlorophyll in fresh leaves of mungbean (mg/g fresh weight of leaves) in comparison to rest of the treatment combinations. The chlorophyll content in fresh leaves i.e., 3.489, 3.502 and 3.496 was significantly maximum in mungbean at 40 DAS in plot receiving T9: RDF (75%) + FYM (5t/ha) + (Rh + PSB) treatment combination during the both summer season i.e., 2020-21, 2021-22 and pooled followed by T8 and T7 treatment combination while minimum chlorophyll content in fresh leaves was found in T1: Control treatment combination i.e., 2.410, 2.415 and 2.412, respectively.

Table 4.1.4:- Effect of Integrated Nutrient Management on Chlorophyll Content in Leaves (mg/g fresh weight of leaves) of Mungbean at 40 DAS.

Treatments	Chlorophyll Content in Leaves (mg/g fresh weight of leaves) at 40 DAS		
	2021	2022	Pooled
T_1: Control	2.410	2.415	2.412
T_2: RDF (20 kg N + 40 kg P2O5/ha)	2.510	2.523	2.517
T_3: RDF + Rhizobium + PSB	2.820	2.833	2.826
T_4: FYM (10 Kg/Ha)	2.957	2.970	2.964
T_5: FYM + Rh + PSB	3.012	3.025	3.019
T_6: RDF (50%) + FYM (2.5 t/ha) + (Rh+ PSB)	2.566	2.578	2.572
T_7: RDF (50%) + FYM (5 t/ha) + (Rh+ PSB)	3.213	3.226	3.220
T_8: RDF (25%) + FYM (5 t/ha) + (Rh+ PSB)	3.347	3.360	3.353
T_9: RDF (75%) + FYM (5 t/ha) + (Rh+ PSB)	3.489	3.502	3.496
SEm±	**0.037**	**0.045**	**0.028**
CD at 5 %	**0.108**	**0.131**	**0.079**

Yield Attributes:

Seed Yield (Kg ha $^{-1}$)

The data pertaining to the seed yield (kg ha $^{-1}$) as influenced by different integrated nutrient management treatments was statistically analyzed given in Table 4.2.1 reveals that the seed yield (kg ha $^{-1}$) was significantly affected by nine treatment combinations on integrated nutrient management during the summer season of the year 2021 and 2022 of mungbean. The seed yield (kg ha $^{-1}$) was observed lowest in control plot (T1) i.e., 1020, 1031 and 1026, respectively but it was increases with different combinations of integrated nutrient management treatments applied among the other plots and it was found highest seed yield (kg ha $^{-1}$) under T9: RDF (75%) + FYM (5t/ha) + (Rh + PSB) treatment combination i.e., 2379, 2484 and 2432 were observed during the both summer seasons with pooled explicit closely followed by T8: RDF (50%) + FYM (5t/ha) + (Rh + PSB) and T7: RDF (25%) + FYM (5t/ha) + (Rh + PSB).

Table 4.2.1:- Effect of Integrated Nutrient Management on Seed Yield (Kg/ha) of Mungbean during summer.

Treatments	Seed Yield (Kg/ha)		
	2021	**2022**	**Pooled**
T_1: Control	1020	1031	1026
T_2: RDF (20 kg N + 40 kg P2O5/ha)	1381	1523	1452
T_3: RDF + Rhizobium + PSB	1621	1787	1704
T_4: FYM (10 Kg/Ha)	1860	2052	1956
T_5: FYM + Rh + PSB	1966	2168	2067
T_6: RDF (50%) + FYM (2.5 t/ha) + (Rh+ PSB)	1801	1987	1894
T_7: RDF (50%) + FYM (5 t/ha) + (Rh+ PSB)	2153	2375	2264
T_8: RDF (25%) + FYM (5 t/ha) + (Rh+ PSB)	2269	2460	2364
T_9: RDF (75%) + FYM (5 t/ha) + (Rh+ PSB)	2379	2484	2432
SEm±	**39.86**	**39.00**	**26.04**
CD at 5 %	**116.35**	**113.84**	**74.05**

Harvest Index (%)

It is the ratio of economic yield and biological yield expressed in terms of percentage. The data pertaining to the harvest index (%) as influenced by different integrated nutrient management treatments was statistically analyzed and presented in Table 4.2.2 indicated that the harvest index (%) was significantly affected by different treatment combinations on integrated nutrient management applied during the summer season of the year 2021 and 2022 on mungbean. The harvest index (%) was observed lowest in T9: RDF (75%) + FYM (5t/ha) + (Rh + PSB) treatment combination i.e., 46.17 per cent, 47.03 per cent, and 46.60 per cent, respectively and it was observed highest harvest index (%) under control plot (T1) i.e., 48.07 per cent followed by 47.43 per cent (T3), 47.23 per cent (T7) and 47.20 per cent (T5) during the summer season of 2021. In the summer season of 2022, the harvest index was observed highest under T7 treatment combination i.e., 49.41 per cent with application of RDF (25%) + FYM (5t/ha) + (Rh + PSB) closely followed by 49.37 per cent (T5), 49.36 per cent (T2) and 49.33 per cent (T4). The pooled data from the given Table 4.2.2 indicated that the highest harvest index (%) was found under the treatment combination T3 with the application of RDF (100%) + Rhizobium + PSB closely followed by T7 (48.32%), T5 (48.28%) and T4 (48.26%).

Table 4.2.2:- Effect of Integrated Nutrient Management on Harvest Index (%) of Mungbean during summer.

Treatments	Harvest Index (%)		
	2021	**2022**	**Pooled**
T_1: Control	48.07	47.15	47.61
T_2: RDF (20 kg N + 40 kg P2O5/ha)	47.08	49.36	48.22
T_3: RDF + Rhizobium + PSB	47.43	49.25	48.34
T_4: FYM (10 Kg/Ha)	47.19	49.33	48.26
T_5: FYM + Rh + PSB	47.20	49.37	48.28
T_6: RDF (50%) + FYM (2.5 t/ha) + (Rh+ PSB)	47.18	49.31	48.25
T_7: RDF (50%) + FYM (5 t/ha) + (Rh+ PSB)	47.23	49.41	48.32
T_8: RDF (25%) + FYM (5 t/ha) + (Rh+ PSB)	47.24	49.02	48.13
T_9: RDF (75%) + FYM (5 t/ha) + (Rh+ PSB)	46.17	47.03	46.60
SEm±	**1.48**	**1.32**	**0.92**

CD at 5 %	**NS**	**NS**	**NS**

Summary
There were nine treatment combinations of integrated nutrient management i.e. T1: Control, T2: RDF (20 kg N + 40 kg P2O5/ha), T3: RDF + Rhizobium + PSB, T4: FYM (10 Kg/Ha), T5: FYM + Rh + PSB, T6: RDF (50%) + FYM (2.5 t/ha) + (Rh+ PSB), T7: RDF (50%) + FYM (5 t/ha) + (Rh+ PSB), T8: RDF (25%) + FYM (5 t/ha) + (Rh+ PSB) and T9: RDF (75%) + FYM (5 t/ha) + (Rh+ PSB) with four replications under Randomized Block Design.

The various periodical observations on important growth characters, yield attributes, yield, nutrient content, nutrient uptake, and benefit cost ratio after harvest of crop were recorded and average data tabulated for statistical analysis. The results presented and discussed in the preceding chapters are summarized as below.

Effect of integrated nutrient management on growth parameters

1. Under the present investigation, the plant population of mungbean at different growing intervals i.e., 20 DAS, 50 DAS and at harvest during both the summer seasons 2021 and 2022 with pooled average was non-significantly influenced due to different treatment combinations of integrated nutrient management.
2. The maximum plant height at different growing intervals i.e20 DAS, 50 DAS and at harvest were significantly influenced due to different treatment combinations of integrated nutrient management applied in both summer seasons of the year 2021 and 2022 with pooled. The application of T9 treatment combination with RDF (75%) + FYM (5 t/ha) + (Rh + PSB) was found to be superior at 20 DAS, 50 DAS and at harvest.
3. The Effect of different treatment combinations under integrated nutrient management on plant dry matter accumulation (gram per 0.5 sq. meter row length) was remarkably affected at 20 DAS, 50 DAS and at harvest in both summer season of the year 2021 and 2022 with pooled. At 20 DAS, 50 DAS and at harvest, the application of T9 treatment combination with RDF (75%) + FYM (5 t/ha) + (Rh + PSB) was found remarkably superior during both seasons in increasing the plant dry matter accumulation (gram per meter row length).
4. The chlorophyll content in leaves of mungbean (mg/g fresh weight of leaves) was significantly affected due to the effect of different treatment combinations of integrated nutrient management at 40 DAS in both summer seasons of the year 2021 and 2022 with pooled. The plot receiving T9 treatment combination with RDF (75%) + FYM (5 t/ha) + (Rh + PSB) was found to be most superior at 40 DAS and significantly increasing the chlorophyll content in fresh leaves of mungbean.
5. The seed yield (Kg ha $^{-1}$), harvest index (%) were significantly influenced in the present investigation due to effect of different treatment combinations of integrated nutrient management for both years i.e., 2021 and 2022 with pooled and T9 treatment combination: RDF (75%) + FYM (5t/ha) + (Rh + PSB) was applied this treatment exhibited its superiority over T1: Control.

Conclusion:-

Based on two years experimental finding on mungbean under the influence of integrated nutrient management during the both seasons i.e., 2021 and 2022 with pooled, it appeared that conjoint application of T9 treatment combination RDF (75%) + FYM (5t/ha) + (Rh + PSB) resulted in significantly superior in plant height, plant dry matter accumulation (gram per 0.5 sq. meter row length), number of branches (plant^{-1}), chlorophyll content in leaves (mg/g fresh weight of leaves), seed yield (Kg ha $^{-1}$), harvest index (%).

For sustainably increasing agriculture productivity, research-based recommendations must focus on integrated use of organic manures, bio-fertilizer along with synthetic fertilizer rather than increase the rate of recommended synthetic fertilizers that provide high yields, grain quality and adequate soil fertility.

Addition of FYM and VC with inorganic fertilizers improves organic matter content of soil and consequently water holding capacity of soil. Nutrient replenishment by merely adding chemical fertilizers is often not economically feasible and even in the technically, it may not be in balance with the supply of organic matter.

Our study reflects those integrated use of chemical fertilizers, organic manures with rhizobium and PSB, assume greater significance of improving efficiency of chemical fertilizers in soil health or soil biodiversity, developing the biological activities, increasing the environmental hygiene, conservation and supporting the ecology. Integrated use of organic and inorganic fertilizer also increased seed protein content compared to use of chemical fertilizer alone. Therefore, it is concluded that the mungbean crop grown in Malwa region of Madhya Pradesh under different

treatment combinations of integrated nutrient management at different growing intervals may be used and the crop should be fertilized with application of T9 treatment combination RDF (75%) + FYM (5t/ha) + (Rh + PSB).

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