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# Integrated nutrient management in mungbean-safflower sequence cropping in vertisols under rainfed conditions

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**Abstract**
Optimization of nitrogen and phosphorus fertilizers for mugbean- safflower sequence cropping was studied during *Rabi* 2004-05 and 2005-06 through integrated use of chemical fertilizers and biofertilizers like Azospirillum and phosphorus solubalising bacteria [PSB]. The pooled results clearly indicated that application of 50% NP to mungbean and 100% NP to safflower in sequence cropping recorded significantly higher safflower seed yield of 1709 kg/ha compared to other treatments which was due to more branches/ plant (11.7) and capitula/plant of safflower (29.3). The same treat recorded significantly higher gross returns of Rs. 35,867/ha, net returns of Rs. 24,832/ha and B:C ratio of 3.25 and also oil yield of 484 kg/ha compared to other integrated nutrient management practices.

**Key words:** Safflower – mungbean - integrated nutrient - sequence cropping - vertisols

## Introduction
Decreasing soil fertility has also raised the concerns about the sustainability of agricultural production at current levels. Further, strategies for increasing agricultural productivity will have to focus on using on using available nutrient resources more efficiently, effectively and sustainable than in the past. Integrated management of the nutrients needed for proper plant growth together with effective crop, water, soil and land management will be critical for sustaining agriculture over long term. Owing to the ever increasing cost of inorganic chemical fertilizers, the integration of inorganic fertilizers with organic manures and crop residues has become imperative for sustained crop production and maintenance of soil health [Babulkar, 2000]. The mungbean-safflower is a promising and profitable crop sequence in Northern Dry Zone of Karnataka. Hence, a filed experiment was conducted to study, the effect of integrated nutrient management in this sequence on vertisols under rainfed conditions.

## Materials and methods
The experiment was conducted on vertisols at Agricultural Research Station, Annigeri during *Rabi* 2004-2005 and 2005-06. The experiment comprised of twelve treatments of fertilizers in combination with biofterilizers, PSB etc., and laid out in randomized block design with three replications. The soil of the experimental site had pH of 8.1 with medium, low and high status of available nitrogen phosphorus and potassium respectively. The mungbean crop was sown during kharif [July] and safflower during Rabi [October] and harvested during September and April respectively during both the years. The mungbean var. Chinamung and safflower var. A-1 were used as test crops. The PSB culture was used through seed dressings as per treatments. All the recommended cultural practices were followed for both the crops.

## Results and discussion
The study of two years revealed the significant effect of different integrated nutrient management practices on growth and yield components of safflower except plant height and 100 seed weight [Table-1]. The fertilizer dose of 50%NP to mungbean followed by 100%NP to safflower recorded significantly higher branches/plant [11.7] and capitula/plant [29.3] compared to other practices and thus resulted in higher safflower yield of 1709 kg/ha. None of the integrated nutrient management practices influence significantly the oil content of safflower. While the former treatment recorded significantly higher oil yield of 484 kg/ha compared to others. This was mainly attributed to higher safflower yield. Further, application of 50% NP [10-

20-10kg NPK/ha] to mungbean and 100% NP [40-40-20 kg NPK/ha] to safflower crop recorded significantly highest seed yield of mungbean [1184 kg/ha] and safflower [1709 kg /ha] (Table-2). But seed yield of mungbean was found at par with T3, T5, T8, T9, 10,T11, and T12 treatments. While seed yield of safflower was found at par with T5, T7, and T10 treatments. Similar results were reported by Masood and Mishra, [2002]. The higher safflower yield was attributed mainly to more braches/plant [11.7] and capitula/plant [29.3]. The mungbean and safflower recorded significantly the highest gross returns of Rs.35867/ha, net returns of Rs. 24832/ha and B:C ratio of 3.25 due to the application of 50%NP to mungbean and 100% NP to safflower in sequence cropping compared to other nutrient management practices [Table-2]. The present results were in line with findings of Karle *et al*. [2003].

**Conclusion**

Thus it could be concluded that a fertilizer doze of 50% NP to mungbean and 100% NP to safflower was optimum in sequence in cropping to enhance the total productivity.

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Table-1. Growth, yield components and oil yield of safflower as influenced by integrated management practices [Pooled over 2 years]

| Sl No. | Treatments | Plant Height [cm] | Branches/ plant | Capitula/ Plant | 100-seed weight[g] | Oil content [%] | Oil yield [kg/ha] |
|---|---|---|---|---|---|---|---|
| | Mungbean - Safflower | | | | | | |
| 1 | Zero NP - Zero NP | 59.7 | 8.0 | 22.3 | 5.73 | 28.5 | 312 |
| 2 | 50% NP - 50% NP | 64.0 | 10.3 | 27.0 | 5.71 | 28.7 | 417 |
| 3 | 50% NP - 100% NP | 63.0 | 11.7 | 29.3 | 5.89 | 28.3 | 484 |
| 4 | 100% NP - 50% NP | 61.0 | 9.3 | 28.3 | 5.77 | 28.5 | 347 |
| 5 | 100% NP - 100% NP | 60.7 | 11.0 | 23.7 | 5.69 | 28.5 | 431 |
| 6 | 100% NP - 50% N+100% P | 63.0 | 9.0 | 24.0 | 5.67 | 28.7 | 324 |
| 7 | 100% NP – Azosp+100% P | 64.0 | 11.0 | 26.0 | 5.67 | 28.2 | 455 |
| 8 | 100% NP - 50% N+Azosp+100% P | 65.3 | 11.0 | 24.7 | 5.71 | 28.0 | 388 |
| 9 | 100% NP - Azosp+PSB | 59.0 | 8.3 | 23.0 | 5.76 | 29.0 | 327 |
| 10 | 100% NP - 50% N+Azosp+100% P | 61.3 | 8.7 | 24.7 | 5.78 | 28.6 | 460 |
| 11 | 100% N+50%P+PSB -100% NP | 64.0 | 11.0 | 23.3 | 5.73 | 28.1 | 351 |
| 12 | 100% N+50%P+PSB – 50%N + Azosp + PSB | 64.5 | 9.7 | 25.0 | 5.47 | 28.7 | 407 |
| | S. Em+ | 1.6 | 0.7 | 2.5 | 0.06 | 0.8 | 10 |
| | C.D.[5%] | NS | 2.2 | 7.9 | N.S. | N.S. | 28 |

Table-2. Seed yield and economics of mungbean and safflower as influenced by integrated nutrient management practices
[Pooled over 2 years]

| Sl. No. | Treatments | Seed yield [kg/ha] | | Gross returns [Rs/ha] | | | Net returns [Rs/ha] | | | B: C ratio |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mungbean - Safflower | Mungbean | Safflower | Mungbean | Safflower | Total | Mungbean | Safflower | Total | |
| 1. | Zero NP - Zero NP | 765 | 1094 | 9945 | 14222 | 24167 | 5425 | 9072 | 17797 | 2.50 |
| 2. | 50% NP - 50% NP | 1184 | 1450 | 15392 | 18850 | 34242 | 10958 | 12938 | 23896 | 3.20 |
| 3. | 50% NP - 100% NP | 1050 | 1709 | 13650 | 22217 | 35867 | 8856 | 15976 | 24832 | 3.25 |
| 4. | 100% NP - 50% NP | 994 | 1216 | 12922 | 15808 | 28730 | 7860 | 9896 | 17756 | 2.62 |
| 5. | 100% NP - 100% NP | 1084 | 1511 | 14092 | 19643 | 33735 | 9030 | 13402 | 22432 | 2.98 |
| 6. | 100% NP - 50% N+100% P | 840 | 1125 | 10920 | 14625 | 25545 | 5858 | 8597 | 14455 | 2.30 |
| 7. | 100% NP – Azosp+100% P | 890 | 1616 | 11570 | 21008 | 32578 | 6508 | 15104 | 21612 | 2.95 |
| 8. | 100% NP - 50% N+Azosp+100% P | 1080 | 1386 | 14040 | 18018 | 32058 | 8978 | 11983 | 10961 | 2.89 |
| 9. | 100% NP - Azosp+PSB | 1094 | 1128 | 14222 | 14664 | 28886 | 9160 | 9644 | 18804 | 2.87 |
| 10. | 100% NP - 50% N+Azosp+100% P | 1099 | 1612 | 14287 | 20956 | 35243 | 9225 | 15024 | 24249 | 3.21 |
| 11. | 100% N+50%P+PSB -100% NP | 1110 | 1251 | 14430 | 16263 | 30693 | 9567 | 10022 | 19589 | 2.76 |
| 12. | 100% N+50%P+PSB – 50%N + Azosp+ PSB | 1110 | 1415 | 14430 | 18395 | 32825 | 9567 | 12463 | 22030 | 3.04 |
| | S. Em+ | 45 | 74 | 588 | 964 | 1112 | 641 | 964 | 1497 | - |
| | C.D.[5%] | 136 | 217 | 1768 | 2827 | 3272 | 1923 | 2827 | 4385 | - |

Recommended NPK (kg $ha^{-1}$) : Mungbean : 20:40:20 Safflower : 40:40:20
Initial Nutrient Status (kg $ha^{-1}$) : 241N : 17 $P_2O_5$ : 537 $K_2O$
Prices of mungbean and safflower – Rs. 1300/q