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STANDARDIZATION OF NPK FOR LUPINE (*LUPINUS PERENNIS* L.) CUT FLOWER PRODUCTION UNDER THE HILL ZONE OF KARNATAKA INDIA

Pooja Murthy S.*, B. Hemla Naik, Chandrashekar S.Y., Thippeshappa G. N. and Kantharaj Y.

Department of Floriculture and Landscape Architecture, College of Horticulture,
Mudigere – 577132, Karnataka, India
(Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga - 577412.)
*Corresponding author E-mail: poojamurthy0808@gmail.com

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ABSTRACT

Lupine is a showy hardy annual and biennial flowering plant. They are mainly grown for cut flowers and food sources. In crop performance, yield and quality result from genotypic expression, modulated by continuous interaction with the environment and other plant behavior factors. Among them, nutrients are the essential factor. The present study was formulated with different doses of nitrogen, phosphorus and potassium along with a control to standardize the optimum dose of NPK to improve the quality and quantity of Lupine.

An investigation was carried out at the College of Horticulture, Mudigere, 2020-21. The experiment consisted of different levels of nitrogen, phosphorus and potassium kg/ha (T_1-85:21:43, T_2-50:20:40, T_3-50:25:40, T_4-75:20:40, T_5 75:25:40, T_6-50:20:45, T_7-50:25:45, T_8-75:20:45, T_9-75:25:45 and T_{10}-Control).

The results reveal that fertilizer treatments had a significant response on all parameters. The minimum days taken for first visible flower bud formation (46.07), days taken for flower stalk emergence (48.20), days required for blooming from Days After Sowing (DAS) (51.07), days taken for 50 percent flowering (25.40), the maximum duration of flowering (58.03 days), days taken for wilting from Days After Flowering (DAF) (5.01), number of florets per stalk (131.80), diameter of flower (2.22 cm), stalk length (71.56 cm), vase life (4.85 days), cut flower yield per plant (5.50 stalks), per plot (192.50 stalks), per hectare (4.07 lakh) and highest BC ratio 5.95 were recorded by application of 75:25:45 kg NPK per ha which was found better over the check (85:21:43 kg NPK/ha).

It can be concluded from the present investigation that nitrogen, phosphorus, and potassium play a significant role in the morphological characteristics of lupine. Hence, NPK at the rate of 85:21:43 kg per ha can be recommended for commercial cultivation of lupine under the hill zone of Karnataka.

***Keywords*:** *Lupinus perennis* L., Nitrogen, NPK, Phosphorus and Potassium

Introduction

Lupine (*Lupinus perennis* L.) is a showy hardy annual and biennial flowering plant in Fabaceae with the chromosome number 2n = 36, 48 or 96 (Naganowska *et al.*, 2003), originated from Eastern North America. Lupine blooms are unique, colorful and beautiful. In nature, they may give flair to any flower garden design, by creating magnificent bright displays or just enhancing landscaping concepts with coloured dots (Anon., 2016). It is primarily used as bedding, border, edging, filler and companion crop in ornamental gardening. Its area and production were estimated at 930,717 ha and 1,610,969 tons, respectively, around the world in 2017. Oceania (Australia) is the largest producer followed by Europe (Abraham *et al.,* 2019). In crop performance, yield and quality result from genotypic expression, which is modulated by continuous interaction with the environment and other factors governing plant behavior. Of them, nutrients are the primary factor limiting the plant's growth and development. A sufficient supply of nutrients, particularly N, P and K is frequently seen as critical for achieving a crop's optimum yield (Arakeri *et al*., 1956). Sufficient nitrogen supply helps in higher photosynthetic activity, solid vegetative growth and carbohydrate consumption (Hillman and Galston, 1961). On the other hand, an abundance of phosphorus promotes faster root growth, aids in seed formation, and the early maturity of crops (Tisdale *et al*., 1995). Potassium gives plant vigor and disease resistance thus improves the quality of crops (Heard *et al*., 2006).

Although lupine is one of the important annual winter-flowering crops, very little work has been reported, so it is necessary to study the nutrient requirement. In the present study, it was formulated with different doses of nitrogen, phosphorous and potassium along with a control to standardize the optimum dose of NPK to improve the quality and quantity of cut flower of lupine.

Materials and Methods

The Department of Floriculture and Landscape Architecture, College of Horticulture, Mudigere (under Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga) conducted an open-field investigation in 2020–21 to standardize NPK for lupine (*Lupinus perennis* L.) cut flower production under the Karnataka hill zone. The experiment was laid out in Randomized Complete Block Design (RCBD) comprising of ten treatments and three replications each. The experiment consisted of different levels of N, P and K kg per ha (T_1-85:21:43 (Check), T_2 - 50:20:40, T_3 - 50:25:40, T_4-75:20:40, T_5-75:25:40, T_6-50:20:45, T_7- 50:25:45, T_8-75:20:45, T_9-75:25:45 and T_{10}- Control). The Recommended Dose of Fertilizer (RDF) is 85:21:43 kg per ha was taken as a check (T_1) from the package of practices (POP) of Dr. Y. S Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. Whereas, 0:0:0 kg NPK/ha was kept as control (T_{10}).

The leveled experimented area was divided into 30 equal plots of 2.20 × 2.20 m of flatbeds and a 0.5 m width path between the beds. Subsequently, 5 kg of well-decomposed Farm Yard Manure (FYM) per m^2 was added to the beds. Lupine seeds were procured from the experimental farm of the Department of Floriculture and Landscape Architecture, Dr. Y. S Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. Direct sowing of overnight-soaked seeds was done in the plot at a spacing of 30 × 45 cm and a depth of 2 to 3 cm. During sowing, the complete phosphorus dose, and the split doses of nitrogen and potassium in the form of rock phosphate, urea, and muriate of potash, respectively, were applied in accordance with the treated combinations. The remaining dose of nitrogen and phosphorous was applied to the crop during flower bud differentiation. To record different parameters at different phases of crop growth, five randomly selected plants from each treatment were tagged (Fig. 1). The pool data were statistically analyzed as per the method suggested (Panse and Sukhatme, 1989).

Results and Discussion

The study's findings on the response of NPK rate on crop characters of lupine have been presented here.

The application of NPK at different doses on lupine plants showed a significant effect on the flowering parameters of lupine. Table 1 clearly shows that minimum days taken for first visible flower bud formation (46.07), days taken for flower stalk emergence (48.20), days required for blooming from DAS (51.07), days taken for 50 per cent flowering (25.40), the maximum duration of flowering (58.03 days) and days taken for wilting from DAF (5.01) were recorded by the application of 75:25:45 kg NPK per ha. Whereas, the control recorded the maximum days for first visible flower bud formation (56.60), days taken for flower stalk emergence (60.13), days required for blooming from DAS (64.43), the days taken for 50 per cent flowering (42.67), the minimum duration of flowering (36.73 days) and days taken for wilting from DAF (2.94).

The results mentioned above may be attributed to an increase in nitrogen levels up to 75 kg per hectare. It is important to note that any further increase beyond 75 kg per hectare did not produce statistically significant changes in these parameters as higher nitrogen that prolongs the vegetative growth phase delayed flowering, ultimately delayed maturity as reported by Rashid *et al*. (2021). The development of floral primordial was eventually promoted by the simulative effect of nitrogen in protein synthesis and carbohydrate assimilation, which is the reason the adequate nitrogen-fertilized plants showed accelerated flowering as reported by Singh *et al*. (2020). Thus, in this case, lupine can save up to 10 kg of nitrogen per hectare. These results align with the findings reported by Khan and Ahmad (2004) who reported that moderate doses of N, and higher doses of K and P exhibited a more pronounced effect on floral characteristics in gladiolus. According to Sajid and Amin (2014), phosphorus is a crucial component of protoplasm and chlorophyll, which aids in the conversion of photosynthates into phospholipids, resulting in sufficient vegetative development and early flower formation. According to Stockman *et al.* (1983), potassium promotes the rate of photosynthesis (Lauchli and Pfluger, 1978) and the mobilization of sucrose to the shoots, both of which have a favorable impact on the initiation of flowers. These findings closely correspond with those of Shaukat *et al.* (2012) in gladiolus, Dahal *et al.* (2014) and Meena *et al*. (2018) in tuberose.

The information in Table 2 showed that the lupine flower quality and yield parameters were significantly impacted by the application of various NPK doses. The maximum number of florets per stalk (131.80), diameter of flower (2.22 cm), stalk length (71.56 cm), vase life (4.85 days), cut flower yield per plant (5.50 stalks), per plot (192.50 stalks) and per hectare (4.07 lakh) were recorded by applying 75:25:45 kg NPK per ha. In contrast, the minimum number of florets per stalk (92.47), diameter of flower (1.30 cm), stalk length (45.85 cm), vase life (2.71 days), cut flower yield per plant (2.57 stalks), per plot (89.95 stalks) and per hectare (1.90 lakh) were recorded in control.

An insignificant increase in the nitrogen doses in the current study suggests that there may have been negative interactions between the nutrients, which may have contributed to the overall inefficiency of the plant-soil environment system beyond the treatment T9 (75:25:45 kg NPK/ha). These results closely match those of Mahmoodinezhadedez fully *et al*. (2012) in tuberose, Khan and Ahmad (2004) in gladiolus, and Bashir *et al*. (2016) in gladiolus. The right amount of nitrogen aids in the production of amino acids, chlorophyll, and improved transformation of carbohydrates, all of which improve stalk development and length and, eventually, increase yield.

The yield of lupine increases with an increase in the phosphorus dosage. It might be because phosphorus plays a vital role in the reproductive stages of crops and increases flower yield. According to Rolaniya (2015), potassium not only confers vigour and disease resistance to plants but is also utilized in the synthesis of amino acids, leading to healthier plants and increased yield. Similar results were also reported in studies on gladiolus by Zamin *et al*. (2020) and Chandana and Dorajeerao (2014), tuberose by Singh *et al.* (2014), Ravi *et al.* (2018) and Sudhagar *et al.* (2020), chrysanthemum by Ahmed *et al.* (2017) and Satar *et al*. (2016).

Table 3 shows the cost of lupine cultivation per hectare as affected by the application of various NPK doses. The economics of the lupine per hectare varied significantly depending on the NPK dosage. Higher gross return, net return, and BC ratio for flower yield that is Rs. 8,74,073, Rs. 7,27,211, and 5.95 have been achieved by the plant given T_9 (75:25:45 kg NPK/ha). Comparatively, control recorded poor yield of flowers and seeds with low income.

Application of the optimum dose of NPK in lupine was found to be beneficial for commercial cultivation. Based on the economic analysis and cut-flower characteristics, the recommended fertilizer dosage for high-quality flower production and increased revenue is 75:25:45 kg per ha (T_9) of NPK. Higher equivalent yield and market price obtained during harvesting may also contribute to higher income. Being a leguminous crop, lupine's high nutritional value puts its seeds in more demand, which boosts revenue. A similar trend was followed by Nanjan *et al.* (1980), Dahal *et al*. (2014) and Meena *et al.* (2018) in tuberose, Mourya and Kushwah (2018) in French bean and Sowmyamala (2012) in gaillardia.

Conclusion

The current study concludes that nitrogen, phosphorus, and potassium are important for lupine growth, flowering, quality, yield, and production of cut flowers and seeds. Regarding flowering, quality, and yield of cut flowers, the NPK at 75:25:45 NPK kg per ha was significantly superior to the check and other treatments examined. Therefore, it can be suggested for the commercial cultivation of lupine in Karnataka's hill region.

Fig. 1 : Flower bud and stalk emergence of lupine

Table 1 : Effect of NPK on flowering parameters of lupine

Tr. No.	Treatments	Days required for first visible flower bud formation	Days taken for flower stalk emergence	Days taken for blooming from DAS	Days taken for 50 percent flowering	Duration of flowering	Days taken for wilting from Days After Flowering
T_1	85:21:43 kg NPK/ha (Check)	46.67	48.80	51.60	29.80	55.07	4.89
T_2	50:20:40 kg NPK/ha	53.87	57.60	61.35	42.00	40.07	3.07
T_3	50:25:40 kg NPK/ha	51.73	53.70	57.05	37.60	45.73	3.38
T_4	75:20:40 kg NPK/ha	49.93	52.07	56.03	35.20	48.93	4.19
T_5	75:25:40 kg NPK/ha	49.47	52.67	56.30	34.53	50.27	4.46
T_6	50:20:45 kg NPK/ha	52.87	56.08	60.01	41.93	45.00	3.19
T_7	50:25:45 kg NPK/ha	50.73	54.92	59.03	37.60	47.73	3.84
T_8	75:20:45 kg NPK/ha	48.93	50.67	54.71	33.13	52.33	4.65
T_9	75:25:45 kg NPK/ha	46.07	48.20	51.07	25.40	58.03	5.01
T_{10}	Control	56.60	60.13	64.43	42.67	36.73	2.94
S.Em±		0.35	0.32	0.21	0.64	0.62	0.05
C.D @ 5%		1.04	0.95	0.62	1.91	1.85	0.14

Table 2 : Effect of NPK on flower quality and yield parameters of lupine

Tr. No.	Treatments	Number of florets per stalk	Diameter of flower (cm)	Stalk length (cm)	Vase life (Days)	Flower yield per plant	Flower yield per plot	Flower yield per hectare (Lakh)
T_1	85:21:43 kg NPK/ha (Check)	126.40	2.08	65.53	4.80	5.36	187.60	3.97
T_2	50:20:40 kg NPK/ha	111.20	1.39	54.07	2.93	3.29	115.15	2.44
T_3	50:25:40 kg NPK/ha	118.33	1.60	58.50	3.84	4.83	169.05	3.58
T_4	75:20:40 kg NPK/ha	128.47	1.85	63.11	4.11	4.89	171.15	3.62
T_5	75:25:40 kg NPK/ha	124.40	2.05	62.32	4.31	4.93	172.55	3.65
T_6	50:20:45 kg NPK/ha	115.27	1.45	56.12	3.51	3.92	137.20	2.90
T_7	50:25:45 kg NPK/ha	119.87	1.70	60.80	4.20	4.84	169.40	3.59
T_8	75:20:45 kg NPK/ha	131.33	2.12	66.15	4.55	5.01	175.35	3.71
T_9	75:25:45 kg NPK/ha	131.80	2.22	71.56	4.85	5.50	192.50	4.07
T_{10}	Control	92.47	1.30	45.85	2.71	2.57	89.95	1.90
S.Em±		0.30	0.03	1.69	0.04	0.20	2.83	0.12
C.D @ 5%		0.89	0.09	5.06	0.13	0.60	8.48	0.35

Table 3 : Effect of NPK on economics of flower yield per hectare of Lupine (*Lupinus perennis* L.)

Tr. No.	Treatment details	Total yield of flower stalks (Lakh/ha)	Total cost of cultivation (Rs./ha)	Gross returns (Rs./ha)	Net returns (Rs./ha)	B:C ratio
T_1	85:21:43 kg NPK/ha (Check)	5.36	1,46,766	8,48,147	7,01,381	5.78
T_2	50:20:40 kg NPK/ha	3.29	1,46,227	4,98,148	3,51,921	3.41
T_3	50:25:40 kg NPK/ha	4.83	1,46,430	7,56,666	6,10,236	5.17
T_4	75:20:40 kg NPK/ha	4.89	1,46,526	7,67,777	6,21,251	5.24
T_5	75:25:40 kg NPK/ha	4.93	1,46,729	7,75,185	6,28,456	5.28
T_6	50:20:45 kg NPK/ha	3.92	1,46,360	6,14,814	4,68,454	4.20
T_7	50:25:45 kg NPK/ha	4.84	1,46,563	7,58,518	6,11,955	5.18
T_8	75:20:45 kg NPK/ha	5.01	1,46,659	7,83,332	6,36,673	5.34
T_9	75:25:45 kg NPK/ha	5.50	1,46,862	8,74,073	7,27,211	5.95
T_{10}	Control	2.57	1,43,750	4,20,370	2,76,620	2.93

References

Abraham, E.M., Ganopoulos, I., Madesis, P., Mavromatis, A., Mylona, P., Nianiou-obeidat, I. and Vlachostergios, D. (2019). The use of lupine as a source of protein in animal feeding: Genomic tools and breeding approaches. *Int. J. Mol. Sci.,* **20**(4), 851.

Ahmed, R., Hussain, M.J., Ahmed, S., Karim, M.R. and Siddiky, M.A. (2017). Effect of N, P and K fertilizer on the flower yield of Chrysanthemum. *Agriculturists* **15**(1), 58-67.

Anonymous (20160) Lushome, https://www.lushome.com/about.

Arakeri, H.R., Chetan, G.V., Donahai, R.L. and Satyanarayan, P. (1956). Soil management in India. *Asia. Pub. House,* Bombay. *pp.54.*

Bashir, M., Khan, I., Qadri, R.W.K., Ashraf, U., Waqas, M.A. and Asif, M. (2016). Optimization of N, P and K to enhance the productivity and quality of *Gladiolus grandifloras* L. *cv*. Essential under semi-arid conditions of Pakistan. *J. Bot* **45**(2), 389-395.

Chandana, K. and Dorajeerao, A.V.D. (2014). Effect of graded levels of nitrogen and phosphorus on growth and yield of Gladiolus (*Gladiolus grandiflorus* L.) *cv*. White Prosperity in coastal Andhra Pradesh*. India Plt. Arch.,* **14**(1), 143-150.

Dahal, S., Mishra, K., Pun, U.K., Dhakah, D.D. and Shaema, M. (2014). Evaluation of split doses of nitrogen at different growth stages of tuberose (*Polianthes tuberosa* L.) for improving flowering and vase-life. *Nepal J. Sci. Technol.,* **15**(1), 23-30.

Heard, J.E., Riechmann, J.L., Creelman, R.A., Keddie, J., Pilgrim, M. L., Dubell, A.N. and Broun, P.E. (2006). Biochemistry-related polynucleotides and polypeptides in plants. U.S. Patent No. 7,135,616. Washington, DC.

Hillman, W.S. and Galston, A.W. (1961). The effect of external factors on auxin content. *Encyclopedia Plt. Physiol.,* **14**, 683-702.

Khan, M.A. and Ahmad, I. (2004). Growth and flowering of *Gladiolus hortulanus* L. *cv*. Wind Song as influenced by various levels of NPK. *Int. J. Agric. Biol.,* **6**(6), 1037-39.

Lauchli, A. and Pfluger, R. (1978). Potassium transport through plant cell membrance and metabolic role of potassium in Plants. Proceeding of 11th congress *Int. Potash Inst*., **6**, 5-57.

Mahmoodinezhadedezfully, S.H., Gholami, A., Moezi, A.A. and Hosseinpour, M. (2012) Effects of nitrogen, potassium and phosphorus on quantitative and qualitative characteristics of tuberose *cv*. Double (*Polianthes tuberosa* L.). *J. Appl. Environ. Biol. Sci*., **2**(9), 485-491.

Meena, R.K., Mahawer, L. N. and Bairwa, H. L (2018) Standardization of NPK dose for growth, floral, bulb and economic parameters on Phule Rajani tuberose. *Indian J. Hort.,* **75**(3), 486-491.

Naganowska, B., Wolko, B., Sliwinska, E. and Kaczmarek, Z. (2003). Nuclear DNA content variation and species relationships in the genus *Lupinus* (Fabaceae). *Ann. Bot.*, **92,** 349–355.

Rashid, K., Akhtar, M., Cheema, K. L., Rasool, I., Zahid, M. A., Hussain, A., Qadeer, Z. and Khalid, M.J. (2021). Identification of operative dose of NPK on yield enhancement of desi and kabuli chickpea (*Cicer arietinum* L.) in diverse milieu. *Saudi J. Biol. Sci.,* **28**, 1063–1068.

Ravi, K., Meena, L.N., Mahawar. and Bairwa, H.L. (2018). Effect of graded levels of nitrogen on production of flower, oil and bulb of tuberose (*Polianthes tuberosa* L.). *Hort. Flora. Res. Spectrum,* **2**(1), 60-63.

Rolaniya (2015). Effect of NPK, biofertilizers and plant spacings on growth and yield of African marigold (*Tagetes erecta* Linn.). *M.Sc. (Agri.) Thesis.* Sri Karan Narendra Agric. Univ., Jobner, Rajasthan.

Sajid, M. and Amin, N. (2014). Effect of various combinations of nitrogen, phosphorus and potash on enhancing the flowering time in Chrysanthemum (*Chrysanthemum morifolium). Int. J. Biosci* **4**(10), 99-108.

Shaukat, S.A., Shah, S.Z.A., Ishaq, Y., Ahmed, M., Shaukat, S.K. and Shoukat, S.W. (2012). Influence of phosphorus fertilization on gladiolus corm and flower production. *J. Agric. Sci*., **1**(5), 105-111.

Satar, V.P., Panchbhai, D.M., Badge, S. and Shivankar, S. (2016). Growth and flower yield of annual chrysanthemum as influenced by nitrogen and phosphorus levels. *Plt. Arch* **16**(2), 523-526.

Singh, D., Singh, V.K., Kumara, S., Pandey, S.K. and Singh, D. (2014) Response of different levels of NPK on growth, flowering and yield of tuberose (*Polianthes tuberosa* L.) *cv*. Shringar. *New. Agr* **25**(2): 1–5.

Singh, U.K., Kumar, S. and Raj, S. (2020). Response of time of planting and nitrogen on growth and flower yield of tuberose (*Polianthes tuberosa* L.) *cv.* Colcatta 'Double'. *J. Pharm. Innov*., **9**(12), 01-03.

Stockman, Y.M., Fischer, R.A. and Brittain, E.G (1983) Assimilate supply and floret development within the spike of wheat. *Aust. J. Plt. Physiol*., **10**, 585-594.

Sudhagar, R., Rajaselvam, M., Kamalakannan, S., Kumar, S. and Maheswari, T.U. (2020). Integrated nutrient management on growth and flower yield of tuberose (*Polianthes tuberosa* L.) *cv*. Prajwal. *Plt. Archives*, **20**, 2415-2418.

Tisdale, S.L., Nelson, W.L., Beaton, J.D. and Havlin, J.L. (1995). Soil fertility and fertilizer. 5th Edition, Prentice-Hall of India, New Delhi. p. 684.

Zamin, M., Khan, A., Jan, I., Rabbi, F., Shah, S., Ali, R., Ullah, K. and Amin, M. (2020). Effect of nitrogen and potash on the yield and quality of gladiolus (*Gladiolus grandiflorus* L) flower. *Sarhad J. Agric.,* **36**(2), 397-401.