**PERFORMANCE OF VARIOUS LATHYRUS ENTRIES UNDER DIFFERENT LEVEL OF PHOSPHORUS DOSES**

**Abstract**

AVT trial on lathyrus was conducted during *rabi* 2022-23 at the ICR farm, Assam Agricultural University, Jorhat, Assam. The aim of the experiment was to assess the performance of different lathyrus entries with level of phosphorus. In the trial, five entries (JCL-21-1, JCL-21-3, IPLa 2021-01, IPLa 2021-03 and KL-5) along with two national checks (Mahateora, Prateek) were evaluated for their responsiveness to phosphorus fertilizer. The three phosphorus levels (40, 60 and 80 kg /ha) were imposed on entries to see the response. The entire dose of phosphorus was applied in strip as basal near to crop. The experiment was conducted in split plot design with entries in main plot and replicated thrice. In terms of GFY, entry KL-5 achieved a significantly higher GFY (208.00 q/ha), which is on par with IPLa 2021-01, demonstrating a 17.05% increase over the performance of the best-performing national check, Mahateora. In terms of both DFY and CP yield, entry KL-5 stood out with a significantly higher DFY of 37.44 q/ha and a CP yield of 4.01 q/ha. Application of 80 kg phosphorus per hectare produced 175.4q/ha green fodder yield, 175.4q/ha dry matter yield with plant height of 58.06 cm.

**Keywords:** *Checks, fertilizer, lathyrus, phosphorus, response*

**Introduction**

Pulses, often dubbed "the poor man’s meat" and "the rich man’s vegetable," are vital sources of protein, minerals, and vitamins, playing a key role in enhancing the nation’s nutritional security. We are now on the brink of achieving self-sufficiency in pulse production, as we are currently the leading producer, consumer, and importer worldwide. If current trends continue, by 2050, we are projected to transition from being a net importer to a net exporter of pulses (Singh et al., 2013).

*Lathyrus sativus* L. is recognized as a valuable agricultural crop, serving as both a grain and forage plant. It offers numerous benefits, including high protein content, substantial dry matter production in a short time, rapid growth, and strong competitive abilities against weeds. Additionally, it plays a significant role in improving soil quality and is highly tolerant of extreme environmental conditions such as drought, flooding, salinity, poor soil fertility, and pest and disease resistance. These characteristics make its cultivation economically efficient and cost-effective. Further research has indicated that the plant's drought tolerance mechanisms could be valuable in developing drought-resistant traits in other crops (Choudhary et al., 2016). It is a highly nutritious plant, offering a significant amount of protein (28%) along with essential minerals such as calcium, phosphorus, and iron (Navaz et al., 2018). It is also an excellent source of vital amino acids, including arginine (7.8 g), lysine (7.4 g), isoleucine (6.7 g), leucine (6.6 g), and valine (4.7 g) per 100 g of protein (Parihar and Gupta, 2016). Among the various species of vetch (Lathyrus), grass pea stands out as the most economically significant and widely cultivated for human consumption, with its seeds being a staple food in numerous countries across Asia and Africa. Grass pea is often referred to as an "insurance crop," as it reliably produces yields even when other crops fail due to extreme environmental conditions (Kalita and Chakrabarty, 2017). The presence of the neurotoxin β-N-oxalyl L-α, β-di-amino propionic acid (ODAP) in the grains of Lathyrus can pose a risk to human consumption, as ODAP is linked to the development of lathyrism, a condition that can lead to irreversible paralysis (Kalita and Chakrabarty, 2017). However, recent advancements have led to the development of low-toxin varieties, which are considered safe for both human and animal consumption (Gupta *et al*., 2015).

Phosphorus plays a vital role in several key processes in grass pea, such as photosynthesis and energy transfer. The roots of grass pea absorb phosphorus from the soil in the form of inorganic phosphate ions. Like all plants, grass pea depends on phosphorus for its growth, development, and reproductive success. Maintaining an adequate phosphorus supply in the soil is essential for maximizing both the yield and quality of grass pea crops (Ray *et al*., 2024). It plays a crucial role in plants by helping capture, store, and convert sunlight into energy-rich biomolecules like adenosine triphosphate (ATP), which power biochemical processes such as photosynthesis. From germination to grain formation and maturity, phosphorus is essential. It is also a key component of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA), which store the genetic information necessary for plants to carry out essential functions, including protein and lipid synthesis, nucleic acid production, and sugar metabolism. Phosphorus supports early root development, enhances winter hardiness, aids seed formation, encourages tillering, and improves water use efficiency. It is indispensable for plant growth and is present in every living plant cell (Das *et al*., 2024). Taking these factors into account, an experiment was conducted to collect data on the performance of various Lathyrus entries under different levels of phosphorus fertilization.

**Materials and methods**

The experiment was conducted at ICR Farm, Assam Agricultural University, Jorhat, Assam during *rabi* season (2022-23). The soil was sandy- loam in texture with pH 5.8 (acidic), organic carbon 0.54 % (medium), available N 265.75 kg/ha (low), available P2O521.30 kg/ha (medium) and available K2O 173.04 kg/ha (medium). In the trial, five entries (JCL-21-1, JCL-21-3, IPLa 2021-01, IPLa 2021-03 and KL-5) along with two national checks (Mahateora, Prateek) were evaluated for their responsiveness to phosphorus fertilizer. The three phosphorus levels (40, 60 and 80 kg /ha) were imposed on entries to see the response. The entire dose of phosphorus was applied in strip as basal near to crop. Total rainfall received during crop growth period was 56.80 mm. The layout of the experiment was based on split-plot design with three replications. Seed rate of 40 kg/ha was taken for sowing. Under growth parameters, plant height (cm) and leaf stem ratio were taken and under yield parameters, green fodder yield (q/ha) and dry matter yield (q/ha) were taken under consideration. Also, crude protein yield(q/ha), crude protein (%), green fodder yield (q/ha/day) and dry matter yield (q/ha/day) were evaluated accordingly. The data recorded in the experiment for each parameter were subjected to analysis of variance for split-plot design (SPD) given by Panse and Sukhatme (1954).

**Results and discussion**

Among the entries, KL-5 demonstrated higher plant height (68.99 cm) which was followed by IPLa 2021-01(65.82). The same entry also showed higher leaf stem ration (1.86) which was at par with IPLa 2021-01(1.72). Among yield parameters, KL-5 demonstrated higher green fodder yield (q/ha) (208.0 q/ha) which was at par with IPLa 2021-01(205.2 q/ha). The same trend was observed in dry matter yield (q/ha) where KL-5 demonstrated higher dry matter yield (q/ha) (37.44 q/ha) which was at par with IPLa 2021-01(36.42q/ha). The higher growth characteristics of this KL-5 entry may be due to superior photosynthesis, efficient nutrient and water uptake, enhanced stress tolerance, improved root development, and favorable genetic traits promoting overall vigor. Similar findings were reported by Das *et al*., 2024. Different level of phosphorus didn’t demonstrate significant difference among the treatments for growth and yield parameters. Among the quality parameters, crude protein yield (q/ha) was found to be highest in KL-5 (4.01 q/ha) followed byIPLa 2021-01 (65.82 q/ha). Meanwhile, IPLa 2021-03 showed highest crude protein (%) (11.48 %) which was at par with Prateek (NC) (11.08%). The higher crude protein percentage in this particular Lathyrus variety may result from its enhanced nitrogen fixation efficiency, improved metabolic processes, or specific genetic traits promoting increased protein synthesis in seeds. Similar findings were also reported by Das *et al*., 2024; Nandini *et al*. (2018),

For per day productivity, IPLa 2021-01 showed higher productivity of 3.33 q/ha/day which was at par with KL-5 (3.23 q/ha/day). Mahateora (NC) showed higher dry matter yield of 0.60 q/ha/day which was at par with IPLa 2021-01 (0.59 q/ha/day) and KL-5 (0.58 q/ha/day). The higher per day productivity could be attributed to superior growth traits, such as faster biomass accumulation, improved nutrient uptake, and efficient photosynthetic efficiency under optimal conditions. Similar findings were reported by Bahramnejad *et al*., 2021.

In terms of phosphorus level, 80 (kg/ha) showed higher crude protein percentage (10.81 %) which was followed by 60 (kg/ha) with a protein percentage of 10.78 %. The higher crude protein percentage may be due to its enhanced nitrogen fixation capacity, optimized metabolic pathways, and genetic traits favoring increased amino acid synthesis, resulting in greater protein accumulation within the plant tissues. Similar findings were reported by Barat *et al*., 2024.

**Table 1: Effect on growth characteristics and biomass yield of Lathyrus**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Entries** | **Plant Height (cm)** | **Leaf Stem Ratio** | **Green fodder yield**  **(q/ha)** | **Dry matter Yield**  **(q/ha)** |
| JCL-21-1 | 58.18 | 1.49 | 160.6 | 30.53 |
| JCL-21-3 | 51.08 | 1.59 | 167.3 | 29.68 |
| IPLa 2021-01 | 65.82 | 1.72 | 205.2 | 36.42 |
| IPLa 2021-03 | 51.84 | 1.63 | 147.8 | 26.44 |
| KL-5 | 68.99 | 1.86 | 208.0 | 37.44 |
| Mahateora (NC) | 50.31 | 1.65 | 177.7 | 34.35 |
| Prateek (NC) | 49.67 | 1.57 | 156.2 | 28.60 |
| **SE(m) ±** | 1.42 | 0.08 | 2.08 | 1.55 |
| **C.D. (P=0.05)** | 2.52 | 0.15 | 3.70 | 2.75 |
| **Phosphorus levels (kg/ha)** | | | | |
| 40 | 55.73 | 1.63 | 173.8 | 32.87 |
| 60 | 55.88 | 1.67 | 174.9 | 31.34 |
| 80 | 58.06 | 1.63 | 175.4 | 31.55 |
| **SE(m) ±** | 1.27 | 0.06 | 1.99 | 1.58 |
| **C.D. (P=0.05)** | 2.71 | 0.12 | 4.23 | 3.38 |

**Table 2: Effect on quality and per day productivity of lathyrus**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Entries** | **Crude Protein Yield**  **(q/ha)** | **Crude**  **Protein (%)** | **Green fodder yield (q/ha/day)** | **Dry Matter**  **yield**  **(q/ha/day)** |
| JCL-21-1 | 3.27 | 10.74 | 2.65 | 0.50 |
| JCL-21-3 | 3.24 | 10.93 | 2.82 | 0.50 |
| IPLa 2021-01 | 3.67 | 10.14 | 3.33 | 0.59 |
| IPLa 2021-03 | 3.04 | 11.48 | 2.48 | 0.44 |
| KL-5 | 4.01 | 10.71 | 3.23 | 0.58 |
| Mahateora (NC) | 3.58 | 10.41 | 3.17 | 0.60 |
| Prateek (NC) | 3.16 | 11.08 | 2.76 | 0.50 |
| **SE(m) ±** | 0.17 | 0.32 | 0.06 | 0.03 |
| **C.D. (P=0.05)** | 0.30 | 0.56 | 0.10 | 0.05 |
| **Phosphorus levels (kg/ha)** | | | | |
| 40 | 3.51 | 10.76 | 2.91 | 0.54 |
| 60 | 3.37 | 10.78 | 2.91 | 0.52 |
| 80 | 3.39 | 10.81 | 2.94 | 0.53 |
| **SE(m) ±** | 0.17 | 0.01 | 0.08 | 0.03 |
| **C.D. (P=0.05)** | 0.36 | 0.01 | 0.17 | 0.06 |

**Conclusion**

The KL-5 entry of Lathyrus demonstrates superior productivity and yield attributes, likely due to its enhanced growth characteristics, efficient nutrient utilization, and genetic traits that promote robust biomass accumulation and optimal seed development, making it a promising variety for cultivation. Additionally, applying 60 kg/ha phosphorus can further enhance overall quality parameters, improving nutrient content and plant health.

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