



Effect of Spacing and Mulching on Growth and Yield of Field Pea (*Pisum sativum* L.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Abstract

Field pea (*Pisum sativum* L.) is an important legume crop grown for its high protein content and ability to improve soil fertility. Proper agronomic practices such as optimum plant spacing and mulching are essential for improving growth, yield, and profitability of the crop. Keeping this in view, a field experiment was conducted during the *rabi* season of 2024–25 at the Experimental Farm of Pandit Deen Dayal Upadhyay Institute of Agricultural Sciences, Utlou, Manipur, to study, “*Effect of spacing and mulching on growth and yield of field pea (Pisum sativum L.)*” The experiment was laid out in a Factorial Randomized Block Design of 9(nine) treatments, containing three levels of spacing and three levels of mulching i.e. T1(S1M1): 20x10cm + no mulch, T2(S1M2): 20x10cm + rice husk mulch, T3(S1M3): 20x10cm + saw dust, T4(S2M1): 30x10cm + no mulch, T5(S2M2): 30x10cm + rice husk, T6(S2M3): 30x10cm + saw dust, T7(S3M1): 40x10cm + no mulch, T8(S3M2): 40x10cm + rice husk, T9(S3M3): 40x10cm + saw dust. The pea variety ‘Rachna’ was used for the study. Observations were recorded on growth parameters, yield attributes, yield, and economics. The results revealed that wider spacing of (40 × 10 cm) (S3) significantly improved growth parameters such as plant height(cm), number of branches, fresh and dry weight(g/plant) and number of nodules per plant. Among mulching treatments, rice husk mulch (M2) performed better than saw dust and no mulch by improving plant growth and yield attributes. The interaction effect showed that the combination of (40 × 10 cm) spacing with rice husk mulch produced the best overall performance in terms of growth and (30 × 10 cm) with rice husk (S2M2) in terms of yield parameter such as number of pods per plant, number of seeds per pod, pod length(cm), stover yield(q/ha) as well as harvest index (%). From the present study, it can be concluded that adopting wider spacing along with rice husk mulching is beneficial for improving the growth, yield, and economics of field pea under the agro- climatic conditions of Manipur.

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1. Introduction

Field pea (*Pisum sativum* L.) is an important cool-season legume cultivated globally for its edible green pods and dry seeds. It is highly valued for its rich nutritional composition, including proteins, carbohydrates, vitamins, minerals, and health-promoting bioactive compounds. The tender pods are widely consumed as fresh vegetables and are also processed into frozen, canned, and dehydrated products, making pea an economically significant crop in both domestic and international markets (Chauhan *et al.*, 2021). In India, field pea is mainly grown during the winter season in plains and as a summer crop in hilly regions. Apart from its role in human nutrition, the crop also provides nutritious fodder through its haulm after pod harvest. Being a leguminous crop, pea establishes a symbiotic association with *Rhizobium leguminosarum*, enabling biological nitrogen fixation, which enhances soil fertility and reduces dependence on synthetic nitrogen fertilizers (Kolb *et al.*, 2017). It also improves soil physical, chemical, and biological properties, thereby contributing to sustainable agricultural systems. The productivity of field pea is strongly influenced by agronomic practices such as plant spacing and mulching. Plant spacing determines plant population, canopy structure, and inter-plant competition for light, water, and nutrients, thereby influencing growth and yield potential. Mulching, on the other hand, plays a crucial role in conserving soil moisture, regulating soil temperature, suppressing weed growth, and improving soil health. Organic mulches additionally enhance nutrient availability through gradual decomposition. However, limited information is available on the combined effect of spacing and mulching under the agro-climatic conditions of Manipur. In this region, agricultural residues such as rice husk and straw are abundantly available but often burned, leading to environmental pollution. Their use as mulch offers a sustainable and cost-effective alternative for improving soil conditions and crop productivity. Therefore, the present study entitled “Effect of spacing and mulching on growth and yield of field pea (*Pisum sativum* L.)” was undertaken to evaluate their influence on growth, yield attributes, and overall productivity under the agro-climatic conditions of Manipur.

2. Material and Methods

The field experiment was carried out during the rabi season of 2024–2025 at the research farm of Pandit Deen Dayal Upadhyay Institute of Agricultural Sciences, Utlou, Bishnupur District, Manipur. The experimental site is located at 24°67' N latitude and 93°57' E longitude, at an elevation of about 790 m above mean sea level. The soil of the site was clay loam in texture, slightly acidic in reaction with a pH of 5.5, and had an electrical conductivity of 0.8 dS/m, indicating non-saline conditions. The soil was found to contain 0.87% organic carbon, while the available nutrient status was 400 ppm nitrogen, 9.8 ppm phosphorus, and 167 ppm potassium. During the period of study, the monthly mean maximum and minimum air temperatures varied from 24.0°C to 32.1°C and 6.7°C to 16.4°C, respectively. Relative humidity ranged between 94% and 98% (maximum) and 30% to 52% (minimum), while wind speed varied from 4.0 to 7.8 km/h. The total monthly rainfall showed wide variation, ranging from 0.76 mm to 63.48 mm, indicating uneven distribution of precipitation during the crop growth period. The experiment was conducted in a Factorial Randomized Complete Block Design (FRBD) with nine treatments and three replications. Two factors were studied, namely spacing and mulching. The spacing levels were S1 (20 × 10 cm), S2 (30 × 10 cm), and S3 (40 × 10 cm), while mulching treatments included M1 (no mulch), M2 (rice husk), and M3 (sawdust). Their combinations formed nine treatments, viz., T1 (S1M1), T2 (S1M2), T3 (S1M3), T4 (S2M1), T5 (S2M2), T6 (S2M3), T7 (S3M1), T8 (S3M2), and T9 (S3M3), which were evaluated on field pea variety ‘Rachna’. Fertilizer was applied uniformly to all plots at the recommended ratio of 20:60:40 kg/ha (N:P:O:K₂O). This was supplied through 43.48 kg/ha nitrogen via urea, 375 kg/ha phosphorus via SSP, and 66.1 kg/ha potassium via MOP. For each plot size of 202.5 m², the equivalent doses were 32.97 g urea, 281.25 g SSP, and 50 g MOP per plot, applied equally to all treatments.

3. Result and Discussion

3.1 Effect of Spacing and Mulching on Plant Height (cm)

Data on the plant height (cm) at 30 DAS, 60 DAS, 90 DAS and at harvest as influenced by spacing and mulching are presented at Table 2. Plant height was significantly influenced by both spacing and mulching treatments at different growth stages except 30 DAS. The widest spacing (40 cm × 10 cm) (S₃) produced the maximum plants height (10.21cm, 30.88 cm, 38.35 cm and 42.63 cm), whereas the closest spacing (20 cm × 10 cm) (S₁) resulted in the minimum plants height (9.20 cm, 28.11cm, 35.90 cm, and 40.26 cm) which may be attributed to reduced competition for light, moisture, nutrients, and growing space under wider spacing. Similar results have been reported by Singh *et al.* (2010) and Kumar *et al.* (2015). Among mulching treatments, rice husk mulch (M₂) recorded the highest plant height (9.85cm, 30.35 cm, 37.27 cm and 41.95 cm), followed by saw dust mulch, while the no mulched (M₁) treatment showed the lowest values (9.20 cm, 28.11 cm, 35.90 cm and 40.26 cm). The beneficial effect of mulching could be due to improved soil moisture conservation, moderated soil temperature, and reduced weed competition, as also reported by Teasdale (1998), Singh and Gupta (2014), and Jaglan *et al.* (2018). The interaction between spacing and mulching was significant at all stages except 30 DAS, with the combination of 40 cm × 10 cm spacing and rice husk mulch producing the tallest plants, whereas the lowest plant height was observed under 20 cm × 10 cm spacing without mulch.

3.2 Effect of Spacing and Mulching on Number of Branches Per Height

Data on the plant height (cm) at 30 DAS, 60 DAS, 90 DAS and at harvest as influenced by spacing and mulching are presented at Table 2. The number of branches per plant was significantly influenced by both spacing and mulching treatments during crop growth. Wider spacing (40 cm × 10 cm) (S₃) produced the maximum plants height (1.50, 2.74, 3.14 and 4.16), produced the maximum number of branches, whereas the closest spacing (20 cm × 10 cm) (S₁) resulted in the minimum number of branches (1.21, 1.83, 2.26 and 3.31), likely due to reduced competition for light, nutrients, moisture, and growing space under wider plant spacing. Similar findings were reported by Meena *et al.* (2011), Biabani (2011), and Kumar *et al.* (2014). Mulching also

significantly increased branches production, with rice husk mulch (M₂) recording the maximum number of branches (1.36, 2.51, 3.01 and 3.99), followed by saw dust mulch, whereas the no mulched (M₁) treatment showed the lowest values (1.26, 2.05, 2.33 and 3.59). This improvement may be attributed to better soil moisture conservation, favourable soil temperature, and enhanced nutrient availability, which promoted vegetative growth and branching, as reported by Nagalakshmi *et al.* (2002), Eid *et al.* (2013), and Awal *et al.* (2016). The interaction between spacing and mulching was significant only at 90 DAS, where the combination of (40 cm × 10 cm) spacing and rice husk mulch (S₃M₂) produced the maximum number of branches, while the minimum was recorded under (S₁M₁).

Table 1. Effect of Spacing and Mulching on Plant Height (cm)

Treatments	30DAS	60DAS	90DAS	At harvest
Spacing				
S1	8.71	27.48	35.40	39.67
S2	9.68	29.13	35.32	40.90
S3	10.21	30.88	38.35	42.63
S.Ed (±)	0.80	0.08	0.32	0.31
C.D(0.05%)	1.70	0.18	0.69	0.96
Mulching				
M1	9.20	28.11	35.90	40.26
M2	9.85	30.35	37.27	41.95
M3	9.55	29.04	36.90	40.98
S.Ed (±)	0.80	0.08	0.32	0.31
C.D(0.05%)	1.70	0.18	0.69	0.96
Spacing x Mulching				
S1M1	8.33	26.92	34.72	39.39
S1M2	9.10	27.74	37.00	40.19
S1M3	8.70	27.77	34.50	39.43
S2M1	9.20	28.40	36.00	40.27
S2M2	10.06	29.88	34.48	41.00
S2M3	9.80	29.13	38.50	41.42
S3M1	10.06	29.01	36.99	41.12
S3M2	10.40	33.43	40.35	44.66
S3M3	10.16	30.22	37.71	42.10
S.Ed (±)	1.39	0.15	0.56	0.54
C.D(0.05%)	N/S	0.32	1.20	1.67

Table 2. Effect of Spacing and Mulching on Number of Branches

Treatments	30DAS	60DAS	90DAS	At harvest
Spacing				
S1	1.12	1.83	2.26	3.31
S2	1.30	2.25	2.89	3.78
S3	1.50	2.74	3.14	4.16
S.Ed (±)	0.09	0.04	0.04	0.17
Mulching				
M1	1.26	2.05	2.33	3.59
M2	1.36	2.51	3.01	3.99
M3	1.50	2.28	2.72	3.67
S.Ed (±)	0.09	0.04	0.06	0.17
C.D(0.05%)	0.19	0.09	0.13	0.36
Spacing x Mulching				
S1M1	1.09	1.52	1.92	3.35
S1M2	1.16	2.00	2.55	3.37
S1M3	1.12	1.98	2.30	3.22
S2M1	1.26	2.08	2.84	3.37
S2M2	1.35	2.54	2.93	3.94
S2M3	1.31	2.15	2.89	3.71
S3M1	1.44	2.56	2.90	3.74
S3M2	1.58	2.99	3.57	4.66
S3M3	1.49	2.70	2.96	4.09
S.Ed (±)	0.15	0.07	0.11	0.29
C.D(0.05%)	0.33	0.16	0.23	0.62

3.3 Effect of Spacing and Mulching on Number of Pods Per Plant

The number of pods per plant was significantly affected by spacing (Table 3). Among the spacing treatments, (30 cm × 10 cm) spacing (S₂) recorded the highest number of pods per plant (8.82), followed by (40 cm × 10 cm) spacing (S₃) (8.78), while the lowest

value was observed under (20 cm × 10 cm) spacing (S₁) (7.98). The higher pod production under S₂ may be attributed to optimum plant population and efficient utilization of growth resources. Similar results were reported by Nandhini *et al.* (2015) and Murade *et al.* (2014). Mulching also significantly influenced pod production. Rice husk mulch (M₂) recorded the highest number of pods per plant (9.03), followed by sawdust mulch (M₃) (8.39), whereas the lowest value was recorded under no mulch (M₁) (8.16). This may be due to improved soil moisture conservation and a favourable root-zone environment under mulched conditions. Similar findings were reported by Devi *et al.* (2021) and Ghosh *et al.* (2006). The interaction effect of spacing and mulching was significant, with S₂M₂ recording the highest number of pods per plant (9.28) and S₁M₁ the lowest (7.28), indicating the beneficial effect of optimum spacing and rice husk mulching on pod production.

3.4 Effect of Spacing and Mulching on Number of Seeds Per Pod

The data on test weight (g) as influenced by spacing and mulching are presented in Table 1. Spacing had a significant effect on the number of seeds per pod. Optimum spacing (30 × 10 cm; S₂) recorded the highest seeds per pod (8.04), followed by wide spacing (S₃) (40 × 10 cm) (7.65), while the lowest was observed under close spacing (S₁) (20 × 10 cm) (6.93). This may be due to optimum plant density enabling efficient resource use without excessive competition. Similar results were reported by Nandhini *et al.* (2015) and Murade *et al.* (2014). Mulching also had a significant effect on number of seeds per pod. Rice husk mulch (M₂) produced the highest seeds per pod (8.01), followed by sawdust mulch (M₃) (7.67), whereas the lowest was recorded in the no mulched control (M₁) (6.95). This may be attributed to improved soil moisture and a favourable root-zone environment under mulch. Comparable findings were reported by Devi *et al.* (2021) and Ghosh *et al.* (2006). The interaction was significant, with S₂M₂ recording the highest seeds per pod (8.40) and S₁M₁ the lowest (6.29), indicating the combined advantage of optimum spacing and rice husk mulch.

3.5 Effect of Spacing and Mulching on Pod Length (cm)

The data recorded on pod length (cm) at harvest are presented in the Table 3. Pod length was significantly affected by spacing treatments. Among the spacing levels, (30 cm × 10 cm) spacing (S₂) produced the highest pods length (7.31 cm), whereas the shortest pod length was observed under (20 cm × 10 cm) spacing (S₁) (6.40 cm). The improvement in pod length under (S₂) may be attributed to optimum plant density, which ensured efficient utilization of available resources and favoured better reproductive growth. Similar observations were reported by Bhattacharya *et al.* (2011) and Yadav *et al.* (2014). Mulching treatments also exerted a significant influence on pod length. Rice husk mulch (M₂) recorded the maximum pod length (7.07 cm), followed by sawdust mulch (M₃) (6.62 cm), while the lowest value was obtained under no mulch (M₁) (6.56 cm). The beneficial effect of mulching may be associated with improved soil moisture availability and a favourable soil environment, which supported better pod development. These findings are in agreement with those reported by Devi *et al.* (2021) and Ghosh *et al.* (2006). The interaction effect of spacing and mulching was significant. The treatment combination S₂M₂ recorded the highest value, whereas the lowest value was observed under S₁M₁.

Table 3. Effect of Spacing and Mulching on Pods per plant, seeds per pods, pod length and seed yield

Treatments	Pods per plant	Seeds per pod	Pod length (cm)	Seed yield (q/ha)
Spacing				
S ₁	7.98	6.93	6.40	12.01
S ₂	8.82	8.04	7.31	14.91
S ₃	8.78	7.65	6.54	13.63
S.Ed (±)	0.06	0.13	0.05	0.10
C.D(0.05%)	0.13	0.28	0.11	0.23
Mulching				
M ₁	8.16	6.65	6.56	12.67
M ₂	9.03	8.01	7.07	14.37
M ₃	8.39	7.67	6.62	13.37
S.Ed (±)	0.06	0.13	0.05	0.10
C.D(0.05%)	0.13	0.28	0.11	0.23
Spacing x Mulching				
S ₁ M ₁	7.28	6.29	6.04	11.23
S ₁ M ₂	8.48	7.26	7.06	12.50
S ₁ M ₃	8.19	7.25	6.10	12.30
S ₂ M ₁	8.54	7.34	7.07	14.00
S ₂ M ₂	9.28	8.40	7.80	15.92
S ₂ M ₃	8.64	8.43	7.06	14.81
S ₃ M ₁	8.66	7.22	6.50	12.47
S ₃ M ₂	9.33	8.35	6.36	14.77
S ₃ M ₃	8.35	7.42	6.54	13.33
S.Ed (±)	0.11	0.23	0.09	0.18
C.D(0.05%)	0.23	0.49	0.20	0.40

3.6 Effect of Spacing and Mulching on Seed Yield (q/ha)

The data recorded on seed yield (q/ha) at harvest are presented in Table 3. Seed yield was significantly influenced by spacing treatments. Optimum spacing (30 × 10 cm; S₂) recorded the highest seed yield (14.91 q ha⁻¹), followed by wider spacing (40 × 10 cm;

S₃) (13.63 q/ha), while the lowest yield was observed under closer spacing (20 × 10 cm; S₁) (12.01 q/ha). The improvement under S₂ may be attributed to an optimum balance between plant population and resource availability, whereas closer spacing likely resulted in greater competition for light, moisture, and nutrients. Similar findings have been reported by Patel *et al.* (2014) and Singh and Yadav (2016). Mulching also had a significant effect on seed yield. Rice husk mulch (M₂) recorded higher yield (14.37 q ha⁻¹), closely followed by sawdust mulch (M₃) (13.37 q/ha), while the lowest yield was obtained under no mulch (M₁) (12.67 q/ha). The beneficial effect of mulching may be associated with improved soil moisture conservation, moderated soil temperature, and enhanced nutrient availability. These results are in agreement with Kumar *et al.* (2015), Das *et al.* (2019), and Devi *et al.* (2021). The interaction effect of spacing and mulching on seed yield was significant, with S₂M₂ recording the highest yield (15.92 q ha⁻¹) and S₁M₁ the lowest (11.23 q ha⁻¹), indicating the combined advantage of optimum spacing and organic mulching in enhancing crop productivity.

4. Conclusion

The present study showed that spacing and mulching significantly affected the growth, yield, and economics of field pea under the agro-climatic conditions of Manipur during the rabi season. Among the treatments, (40 × 10 cm) with rice husk mulch gives better growth parameter, whereas (30 cm × 10 cm) spacing combined with rice husk mulch performed better in terms of growth, yield attributes, seed yield, and economic returns. This may be due to optimum plant population and improved soil moisture conditions under mulching. It is therefore concluded that 30 cm × 10 cm spacing with rice husk mulch is suitable for higher productivity and profitability of field pea in Manipur.

5. Limitation

The findings are limited to one rabi season (2024–25), one experimental location in Manipur, one field pea variety ('Rachna'), three spacing levels, and three mulch treatments. Consequently, treatment responses may vary under different seasons, locations, soil conditions, or cultivars. The conclusions should therefore be interpreted as specific to the experimental conditions evaluated. Multi-season and multi-location validation would be required to assess the consistency and broader applicability of the observed spacing and mulching responses.

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Declaration of AI Use

This manuscript was prepared through the intellectual contributions of the author(s) to the study design, data analysis, interpretation of results, and scholarly content. Grammarly and ChatGPT were used solely to assist with grammatical refinement and reference formatting during manuscript revision. The author(s) accept full responsibility for the accuracy, integrity, and final content of the manuscript.

Competing Interests

Authors have declared that no competing interests exist.

References

- Ahmed, N. and Bhat, M. A. (2024). Impact of biodegradable mulches on soil microbial diversity and legume performance. *Journal of Soil Biology*, 46(1), 33–40.
- Ali, M., Kumar, S. and Ahmad, A. (2012). Effect of plant spacing on growth, yield and harvest index of pea (*Pisum sativum* L.). *Journal of Food Legumes*, 25(3), 210–214.
- Bhattacharya, A., Sarkar, S. and Banerjee, P. (2011). Influence of spacing on growth and yield attributes of garden pea (*Pisum sativum* L.). *Legume Research*, 34(2), 128–131.
- Bhowmik, D. and Roy, S. (2023). Comparative performance of mulching materials in field pea under rainfed conditions. *Indian Journal of Soil Conservation*, 51(1), 12–18.
- Bray, R. H. and Kurtz, L. T. (1975). Nitrogen fixation in bacteria and higher plants. Berlin, Germany: Springer-Verlag, (21), 1–189.
- Chaikee, T., Tsering, T. and Singh, R. (2024). Effect of biofertilizer and plant spacing on growth and yield of field pea (*Pisum sativum* L.). *Ecology, Environment and Conservation*, 30(Suppl. Issue), 133–137.
- Choudhary, M. and Sharma, V. (2014). Effect of mulching on pest incidence and pod quality in field pea. *Journal of Plant Protection Research*, 54(3), 215–220.
- Choudhary, R., Meena, R. S. and Yadav, R. K. (2020). Effect of organic mulching on growth and biomass yield of pulse crops. *International Journal of Chemical Studies*, 8(4), 2341–2345.
- Das, S. and Ghosh, R. (2013). Spacing effects on canopy architecture and light interception in field pea. *Journal of Crop Science*, 53(2), 145–150.

- Das, S., Mandal, M. and Dutta, D. (2019). Effect of organic mulches on yield and yield attributes of pea. *International Journal of Current Microbiology and Applied Sciences*, 8(6), 1456–1462.
- Devi, K. M., Chanu, M. M., Abonmai, T. and Singh, M. S. (2022). Effect of spacing on growth and green pod yield of pea (*Pisum sativum* L. subsp. *hortense*). *The Pharma Innovation Journal*, 11(7), 3183–3186.
- Devi, S., Kumar, R. and Meena, M. L. (2021). Influence of spacing and mulching on productivity of pea (*Pisum sativum* L.). *Journal of Pharmacognosy and Phytochemistry*, 10(1), 1125–1129.
- Istanti, R., Sari, N. P. and Pratiwi, R. (2023). The role of parents in improving the social-emotional development of early childhood aged 0–6 years. *Journal of Early Childhood Education Research*, 12(1), 45–52.
- Jackson, M. L. (1973). *Soil Chemical Analysis*. Prentice Hall of India (Pvt.) Ltd., New Delhi.
- Jat, R. K., Singh, P. and Sharma, A. (2020). Effect of mulching on harvest index and yield of legumes under semi-arid conditions. *Indian Journal of Agronomy*, 65(1), 89–93.
- Kaur, R., Singh, J. and Kaur, G. (2024). Effect of spacing and sowing dates on growth, yield and quality of pea (*Pisum sativum* L.). *International Journal of Research in Agronomy*, 7(2), 137–142.
- Khanda, C. M., Barik, K. C. and Mahapatra, P. K. (2001). Effect of spacing on yield attributes and seed yield of pea. *Orissa Journal of Agricultural Research*, 14(1–2), 45–48.
- Khular, K. K., Devi, K. M., Athokpam, K., Waikhom, K. and Khumanthem, P. (2025). Studies of spacing on growth and yield of different varieties of field pea (*Pisum sativum* L.). *International Journal of Plant & Soil Science*, 37(4), 1–7. 72
- Kumar, A. and Singh, P. (2023). Comparative study of intercropping systems involving field pea and mustard under different row spacings. *Journal of Agronomic Research*, 15(1), 22–29.
- Kumar, A., Singh, D. and Yadav, R. S. (2015). Effect of organic mulches on growth and yield of pea. *International Journal of Agricultural Sciences*, 11(2), 321–325.
- Kumar, S. and Singh, R. (2015). Influence of spacing on growth, yield and harvest index of field pea. *Journal of Crop and Weed*, 11(1), 134–138.
- Kumari, S. and Thapa, R. (2023). Role of organic amendments and spacing in improving field pea productivity. *Journal of Organic Agriculture*, 12(2), 87–94.
- Meena, R. K., Yadav, R. S. and Singh, V. (2012). Effect of organic mulch on soil microbial activity and productivity of field pea. *Indian Journal of Agricultural Sciences*, 82(6), 515–519.
- Meena, R. S., Meena, V. S. and Yadav, G. S. (2017). Effect of plant geometry on growth and biomass production of pulses. *Legume Research*, 40(3), 487–491.
- Mehta, R. S., Patel, B. S. and Patel, J. C. (2018). Effect of mulching on dry matter partitioning and yield of pea. *International Journal of Agricultural Research*, 13(2), 95–99.
- Mishra, H. and Das, A. (2023). Effect of integrated nutrient and mulch management on field pea productivity. *Journal of Sustainable Agriculture*, 15(1), 45–52.
- Pandey, A. K., Verma, S. K. and Tripathi, M. K. (2016). Influence of organic mulching on growth and harvest index of pea. *Indian Journal of Horticulture*, 73(4), 562–566.
- Pandey, R. and Sharma, S. (2011). Combined use of mulch and optimal spacing for improved growth and yield of field pea. *Agricultural Science Digest*, 31(4), 265–268.
- Parida, P. K., Pradhan, S. and Sahoo, S. (2023). Effect of organic mulches on yield, water productivity and economy of garden pea cultivars. *International Journal of Environment and Climate Change*, 13(5), 112–119.
- Patel, M. R. and Chauhan, D. S. (2018). Impact of straw mulch on soil health and productivity of field pea. *Journal of Soil and Crops*, 28(2), 245–250.
- Patel, R. H. and Meena, M. L. (2017). Effect of spacing on growth and stover yield of pea. *International Journal of Agriculture Sciences*, 9(6), 3821–3824.
- Pradhan, S. and Sahoo, R. (2023). Effect of mulch and spacing on nodulation and nitrogen fixation in field pea. *Legume Research*, 46(4), 512–518.
- Rana, D. S., Singh, B. and Chauhan, J. S. (2020). Effect of mulching on yield attributes of vegetable pea. *Vegetable Science*, 47(1), 54–58.
- Rana, R. S. and Thakur, D. R. (2017). Effect of inter-row spacing on field pea yield in temperate climates. *Himachal Journal of Agricultural Research*, 43(1), 55–59.
- Rani, P. and Yadav, M. (2023). Mulching and spacing effects on weed suppression and pod quality in field pea. *Journal of Crop Protection*, 42(2), 95–102.
- Reddy, A. R., Reddy, K. R. and Rao, S. S. (2013). Influence of spacing on growth and biomass yield of pulses. *Journal of Research ANGRAU*, 41(2), 56–60.
- Saxena, A., Singh, V. and Sharma, R. (2016). Effect of organic mulches on pod characters and yield of pea. *International Journal of Agricultural Sciences*, 12(1), 89–93.
- Sharma, R. and Singh, S. (2020). Effect of black polythene mulch on growth and yield of field pea. *Indian Journal of Agronomy*, 65(3), 345–350.
- Singh, A. and Tiwari, R. (2023). Influence of spatial arrangement on nutrient uptake and pod development in field pea. *Journal of Agronomic Studies*, 18(3), 201–208. 73
- Singh, R. and Mehta, P. (2023). Effect of mulch and irrigation scheduling on field pea yield and water-use efficiency. *Agricultural Water Management Journal*, 251, 106–112.
- Singh, T., Raturi, H. C. and Uniyal, S. P. (2023). Effect of biofertilizer and mulch on growth, yield, quality and economics of pea (*Pisum sativum* L.). *Indian Journal of Agricultural Research*, 57(3), 330–335.
- Singh, V. and Kumari, P. (2015). Interaction of spacing and fertilizer application on growth and yield of field pea. *Journal of Plant Nutrition*, 38(10), 1545–1554.
- Subbiah, B. V. and Asijia, G. L. (1956). A rapid procedure for the estimation of available nitrogen in soils. *Current Science*, 25, 259–260.

- Sudhanshu, V. and Pradhan, S. (2024). Effect of mulches on crop, soil and water productivity: A review. *International Journal of Agricultural Sustainability*, 22(1), 1–10.
- Tripathi, A. K., Verma, R. K. and Singh, M. (2014). Effect of mulching on growth and yield of pea under irrigated conditions. *Indian Journal of Agronomy*, 59(3), 456–460.
- Tsering, T. and Chaikhee, T. (2024). Effect of biofertilizer and plant spacing on field pea performance in Arunachal Pradesh. *Ecology, Environment and Conservation*, 30(Suppl. Issue), 133–137.
- Verma, R. and Singh, A. (2016). Combined effect of mulching and drip irrigation on field pea. *Journal of Water Management*, 24(2), 101–106.
- Verma, R. K. and Singh, S. P. (2016). Effect of organic mulching on growth and yield of pulses. *Journal of Food Legumes*, 29(4), 289–293.
- Walkery, A. J. and Black, I. A. (1934). Estimation of organic carbon by the chromic acid titration method. *Soil Science*, 37, 12–38.
- Yadav, A. K. and Singh, R. (2019). Influence of row spacing and plant density on field pea performance. *Indian Journal of Agronomy*, 64(1), 78–83.
- Yadav, R. S., Meena, L. R. and Kumar, S. (2014). Effect of plant spacing on yield attributes of pea. *Legume Research*, 37(1), 88–91.

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