Vegetable Science (2024) 51(2): 306-312

doi: 10.61180/vegsci.2024.v51.i2.15

ISSN- 0970-6585 (Print), ISSN- 2455-7552 (Online)

www.isvsvegsci.in

RESEARCH ARTICLE

Influence of sowing dates on growth dynamics and pod yield of vegetable pea (*Pisum sativum* L.) in relation to agro-meteorological indices in subtropical to sub-humid region of Eastern India

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Abstract

The experimentation was carried out in three replications consisting of eight different sowing dates of vegetable pea. cv. Azad Pea-3 from 12th October (T_1) to 21st December 2021 (T_8), at 10-day intervals between each sowing date. Observations made on various growth and pod yield attributing parameters were statistically analyzed and correlated with mean maximum and minimum temperature as well as average bright sunshine hours recorded during the corresponding phases of crop growth. Results revealed that the parameters under study were substantially affected by various sowing dates. T_6 recorded maximum plant stand (93.53%), T_3 registered highest pod length (9.40 cm) and T_4 produced maximum plant height at 60 DAS (83.77 cm), number of branches per plant (3.97), number of nodules per plant at flowering (26.13), number of green pods per plant (20.80), 10 pods weight (75.67 g), shelling percentage (54.18) along with pod yield (52.06 q/ha). Meanwhile, the lowest value for nodule count was noticed in T_7 and for other parameters in T_1. As per correlation analysis, it was observed that except for plant height (at 20 DAS and 40 DAS) and number of nodules per plant, all other parameters showed a negative association with the meteorological indices under consideration. In general, sowing undertaken between 1st November and 1st December produced a higher pod yield of vegetable pea under North Bihar conditions.

Keywords: Vegetable Pea, Pod, Yield, Sowing dates, Temperature, Sunshine duration.

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Citation: Behera, N.P., Kumar, U., & Pathak, A. (2024). Influence of sowing dates on growth dynamics and pod yield of vegetable pea (*Pisum sativum* L.) in relation to agro-meteorological indices in Subtropical to sub-humid region of Eastern India. Vegetable Science, 51(2), 306-312.

Source of support: Nil

Conflict of interest: None.

Received: 11/03/2024 **Revised:** 20/09/2024 **Accepted:** 27/09/2024

Introduction

Vegetable pea (*Pisum sativum* L.*)* or green peas is one of the oldest cultivated crops grown all over the world for its tender green pods and immature seeds. Pea is a major cool-season vegetable crop in the family Fabaceae (Leguminosae). Due to its low requirements for water, chemicals, and fossil fuels, as well as its capacity to symbiotically fix atmospheric nitrogen, pea cropping has significant advantages in sustainable farming systems (Munier-Jolain & Carrouee, 2003). In India, vegetable pea is cultivated in an area of 567.7 thousand hectares from which annual production is 5852.5 thousand metric tonnes. In Bihar, pea is grown over 11.9 thousand hectares, with 66.3 thousand metric tonnes of annual production (Ministry of Ag. and Farmers Welfare, 2021). Green seeds can be consumed as fresh or alternatively might be used after processing (canning, freezing and dehydration) for use during the off-season and have great potential in domestic as well as export markets. Vegetable pea is typically a cool season crop of temperate and subtropical regions but can also be grown in mild climates of the tropics.

Pea, like other crops, is influenced by weather along with various climate complexities because it cannot thrive in the summer heat or lowland tropical climates. However grows well in cooler and higher-altitude tropical areas

(Oplinger *et al*., 1991). Green peas could be cultivated in temperatures ranging from 10 to 30°C, but they perform best at temperatures between 13 to 18°C and are frost resilient for the initial vegetative growth stages, although the flowers and pods are harmed later on. Temperatures above 25.6°C during flowering and pod setting, according to Wien (1997), reduced pea flower, pod number, and yield. For pea seed germination, the ideal temperature is around 22°C. Germination can occur at temperature conditions as low as 5°C, although at a slower pace (Sirwaiya et al., 2018). Temperatures exceeding 20°C reduce the production besides the quality of immature seeds. Temperature fluctuations during germination increase plant mortality due to desiccation (Sharma et al., 1997), while higher temperatures cause plants to flower earlier, contributing to poor yield (Gajenra et al., 1995). At high temperatures, seed N accumulation is significantly constrained due to a shorter seed-filling period and a lower seed dry-matter accumulation rate (Larmure and Munier-Jolain, 2019). Vegetable pea is a cool-loving crop and on a shortening of winter, the crop may be affected in one way or the other. This has resulted in the shifting of optimum sowing dates and affected the growth and phenology of crops at different stages. With the rise in global temperature, pea seed yield is decreasing and the developing seeds are shown to be aborted when exposed to high temperatures (Jeuffroy et al., 1990). Optimizing a crop's planting time may be one of the most significant climate-resilient tactics for increasing production and hence, it becomes necessary to study the crop growth behaviors in changing climatic conditions. The goal would be to undertake sowing at a period when there is the greatest chance of receiving a favorable condition for the maturation and growth of a seed. Keeping in view of the above aspects, the present investigation was undertaken to study the influence of climatic variability by different sowing dates on the growth and pod yield of vegetable pea under the calcareous soil of north Bihar.

Materials and Methods

The investigation was undertaken during the *Rabi* season of 2021-22 at Vegetable Research Farm, Department of Horticulture, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar, situated at a North latitude of 25.97°, East longitude of 85.86° and altitude of 52.05 m above mean sea level. Throughout the period of investigation, average precipitation of 135.3 mm, relative humidity (Max. 94.92% and Min. 61.74%), an average daily maximum temperature of 25.20^{0}C, minimum temperature of 13.09°C and total sunshine hours of 803.3 were recorded. The study was performed in randomized block design with three replications for vegetable pea Cv. Azad Pea-3 at eight sowing dates *viz.* T1:12th Oct, T2:22nd Oct, T3:1st Nov, T4:11th Nov, T5:21st Nov, T6:1st Dec, T7:11th Dec and T8:21st 20th December tonnes FYM/ha was incorporated into the soil at time of land preparation followed by application of recommended dose of N, P2O5 and K2O @ 60:60:60 Kg/ha at time of sowing. Vegetable pea seeds were sown at an interval of 10 days in plots of 6 m × 1.5 m by maintaining a spacing of 30 cm between the rows and 10 cm between the plants. Manual hand weeding at the initial phase of crop growth, *i.e.,* at 25 DAS and subsequently at 45 DAS, was enough to keep the experimental plot weed-free. The field was irrigated during the flowering and pod formation stages of the crop and also according to the conditions of the soil. To assess the impact of different sowing dates, observations on various characteristics such as growth, length of various phases and pod yield-related parameters were recorded during a period of investigation. Within each treatment, for each replication five plants were randomly selected and tagged properly for recording of related observations from these labeled plants. The data collected on different observations for each treatment were subjected to «Analysis of variance,» as suggested by Panse and Sukhatme (1985). The statistical significance of the 'F' value was calculated at a level of 5% by OP stat software. The mean maximum, minimum temperature and average bright sunshine hours during various phases of plant growth, such as sowing to seedling establishment, sowing to 20 DAS, 20 DAS-40 DAS, 40 DAS-60 DAS, Sowing to first flowering, flowering to harvest and sowing to harvest was recorded at the agro-meteorological observatory of RPCAU campus, Pusa, Samastipur. Simple correlation coefficient (r) was calculated as per Al-jibouri et al. (1958) to determine the relationship between growth parameters, pod yield and its attributing parameters with mean maximum, minimum temperature and bright sunshine hours recorded during the corresponding period of various plant growth phases.

Results and Discussion

Different sowing dates showed a significant impact on various growth as well as pod yield and its attributing parameters (Table 1). The treatment T_6 exhibited maximum plant stand (93.53%) and this was statistically at par with T_7 (92.07%), T_5 (90.11%), T_8 (87.80%), and T_4 (84.78%), while minimum plant stand was obtained in T_1. A significant negative relation was observed between mean maximum (r^2 = -0.758) and minimum temperature (r^2 = -0.868) with plant stand (Table 2). Plant stand was noticed lower in the case of earlier planting dates. This could be on account of the prevalence of high temperatures during sowing to stand establishment period of a crop, which caused decreased germination percentage, seedling emergence, aberrant seedlings, low seedling vigor and poor radical as well as plumule development in germinated seedlings (Hasanuzzaman et al., 2013) and hence resulted in poor crop stand. Considering such effect of temperature, similar results were obtained by Singh and Kumar (1979), Sharma et al. (1997), Dhall (2017) and Lamichaney et al. (2021).

Table 1: Influence of different sowing dates on growth parameters

Treatments	*Plant Stand (%)*	*Plant Height (cm)*			*Number of Branches per plant*	*Number of Nodules per plant at flowering*	*Days to First Flowering*	*Days from Flowering to Harvest*	*Days from Sowing to Harvest*
		20 DAS	*40 DAS*	*60 DAS*					
T_1	76.23	14.37	39.27	63.73	1.60	20.07	29.33	38.33	67.67
T_2	78.91	18.40	46.63	73.87	3.07	23.20	30.33	40.00	69.33
T_3	79.16	18.73	49.87	77.20	3.53	25.33	29.67	42.67	71.00
T_4	84.78	16.87	48.20	83.77	3.97	26.13	33.67	42.67	75.67
T_5	90.11	11.67	40.40	80.43	3.40	21.77	42.67	42.33	85.00
T_6	93.53	14.93	36.74	76.17	3.27	18.03	49.33	43.00	89.33
T_7	92.07	11.27	34.03	74.43	3.40	17.10	46.00	39.67	84.67
T_8	87.80	10.55	31.47	67.87	2.80	19.17	42.33	39.00	79.00
Mean	85.32	14.59	40.82	74.68	3.13	21.35	37.91	40.95	77.70
SE(m)±	3.95	0.81	1.92	3.51	0.15	1.11	1.21	1.14	2.31
CD($p \leq 0.05$)	11.99	2.47	5.81	10.64	0.45	3.36	3.67	3.45	7.02
CV	8.02	9.65	8.13	8.13	8.26	8.99	5.53	4.81	5.16

At 20 DAS T_3 produced the tallest plant (18.73 cm), which was statistically at par with T_2 (18.40 cm) and T_4 (16.87 cm) and the shortest plant was recorded with T_8 (10.55 cm) sowing and also at 40 DAS T_3 produced tallest plant (49.87 cm) and this was at par to T_4 (48.20 cm) and T_2 (46.63 cm) while it was found to be the lowest in case of T_8 (31.47 cm). Plant height at 20 DAS showed a significant positive correlation with the mean maximum temperature ($r^2 = 0.734$) and average bright sunshine hours ($r^2 = 0.805$) as observed from sowing to 20 DAS. Also, at 40 DAS, plant height exhibited a significant positive relation with mean maximum temperature ($r^2 = 0.748$) and average bright sunshine hours ($r^2 = 0.796$) as recorded during 20 DAS to 40 DAS of the crop. Plant height at 60 DAS was maximum in T_4 sowing (83.77 cm), which was statistically equivalent with T_5 (80.43 cm), T_3 (77.20 cm), T_6 (76.17 cm), T_7 (74.43 cm) and T_2 (73.87 cm). Significantly lowest plant height (63.73 cm) was recorded in T_1.

A negative but non-significant relation was obtained for plant height at 60 DAS with mean maximum, minimum temperature and average bright sunshine hours recorded during the corresponding period. Analysis indicates that plant height was favored by maximum temperature along with bright sunshine hours initially from sowing to 20 DAS and 20 DAS to 40 DAS along with other favorable conditions of weather which permitted better crop growth through increased photosynthesis by the newly expanding leaves.

This was most likely owed to more assimilation being utilized to sustain an increased height of vegetative growth. The higher mean maximum temperature during 40-60 DAS induced reproductive growth and hence more assimilates being used towards flowering and pod formation while lower temperature delayed flower initiation, thereby resulting in a prolonged vegetative phase and thus increasing plant height. Higher temperature largely affects the pace of plant development, which increases to a point and then decreases (Wahid et al., 2007). The period of rapid vegetative growth was delayed owing to the effect of lower temperature. This is in agreement with the findings of Srivastava & Singh (1989), Sirwaiya & Kushwah (2018) and Haq & Ahmed (2021).

Table 2: Correlation coefficient between mean maximum and minimum temperature, and average bright sunshine hour during different phases with growth parameters

Growth parameters↓	*TMax. (ºc)*	*TMin. (ºc)*	*Avg. BSH*
Plant Stand (%)	-0.758*	-0.868**	-0.009
Plant Height at 20DAS(cm)	0.734*	0.490	0.805*
Plant Height at 40 DAS(cm)	0.748*	0.374	0.796*
Plant Height at 60 DAS(cm)	-0.603	-0.477	-0.654
Number of Branchesper Plant	-0.592	-0.748*	-0.604
Number of Nodules per Plant at Flowering	0.623	0.315	0.782*
Days to First Flowering	-0.902*	-0.850**	-0.777*
Days from Flowering to Harvest	-0.799*	-0.849**	-0.845**
Days from Sowing to Harvest	-0.899*	-0.841**	-0.858**

(*at 0.05 level of significance and**at 0.01 level of significance)

Maximum number of branches plant^{-1} was produced from T_4 (3.97) sowing and this was found equivalent to T_3 (3.53) sowing. The number of branches plant^{-1} was recorded as lowest in the case of T_1 (1.60). Correlation data revealed a significant inverse relationship with mean minimum temperature (r^2= -0.748) observed during the corresponding period of sowing to harvest of the crop. This might be explained, as disclosed by previous research, on account of the prolonged vegetative period under low temperatures that allowed the formation of more branches along with the impact of other prevailing weather conditions during the period of growth (Sirwaiya & Kushwah, 2018).

A maximum number of nodules plant^{-1} at flowering was produced in T_4 (26.13) sowing and this was statistically at par with T_3 (25.33) and T_2 (23.20). Meanwhile, the lowest was recorded in T_7 (17.10). Correlation data revealed a significant positive relationship with average bright sunlight hours (r^2=0.782) observed during the period from sowing to the observation of root nodules. The possible explanation for this might be related to an increase in soil temperature from solar radiation, which favored rhizobial growth. The prevalence of low temperature significantly lowered nodule growth rate, delayed nodule formation significantly, final nodule size, nodule activity and impacted nitrogenase activity (Schweitzer & Harper, 1980; Junior et al., 2005).

The results from the experiment indicated that sowing dates had exerted a significant influence on the number of days to first flowing, flowering to harvest and sowing to harvest of vegetable pea plant. For first flowering, T_1 took a minimum number of days (29.33) and this was at par with T_3 (29.67) and T_2 (30.33) sowing, while it was maximum in the case of T_6 sowing (49.33).

Correlation data indicated a significant inverse relation with mean maximum temperature (r^2= -0.902) and minimum temperature (r^2= -0.850) as well as average bright sunshine hours (r^2= -0.777) recorded during the phase of sowing to the appearance first flower. This might be because of exposure of plants to warmer temperatures which induced earlier reproductive development. T_1 took the least number of days from flowering to harvest (38.33) and this was at par with T_8 (39.00), T_7 (39.67) and T_2 (40.00). In contrast, T_6 (43.00) took the most for the same. The number of days from flowering to harvest was found to be negatively correlated with mean maximum (r^2= -0.799), minimum temperature (r^2= -0.849) and average bright sunshine hours (r^2= -0.845) observed during the corresponding period of crop season. T_1 took the least number of days from sowing to harvest (67.67) and this was similar with T_2 (69.33) as well as T_3 (71.00), while T_6 (89.33) took the most days. A significant negative association of the number of days from the sowing to harvest period was obtained with both mean maximum (r^2= -0.899) and minimum temperature (r^2= -0.841) as well as bright sunshine hours (r^2= -0.858) observed during the same period. This might be because of slower growth under low temperatures, which prolonged this duration. Previous studies have reported that high day/night temperatures (27/17°C and above 28°C for more than 20 days) significantly reduced pod numbers, shortened reproductive growth, and decreased yield, confirming the adverse effects of heat stress on these traits (Guilioni et al., 1997; Bueckert et al., 2015; Bhandari et al., 2016; Kuznetsov et al., 2020).

The sowing date has exerted a significant effect on the number of green pods per plant (Table 3). T_4 sowing produced a maximum number of green pods (20.80) plant^{-1} and this was statistically equivalent to T_5 (18.23) sowing. Significantly lowest number of green pods plant^{-1} was produced in T_1. A significant negative association was obtained with mean maximum (r^2 = -0.833), minimum temperature (r^2= -0.858) and average bright sunshine hours (r^2= -0.916) observed during flowering to harvest (Tables 4, 5 and 6). This might be owed to the mild temperature and longer growth duration, which ultimately resulted in a diversion of more energy towards more flowering and pod formation. Moreover, flowering, pod formation, along with its development, was limited by high temperatures on account of more sunshine hours during the reproductive phase (Wien, 1997; Bhandari et al., 2016; Lamichaney et al., 2021; Haq and Ahmed, 2021). Length of pods was found to be highest in T_3 (9.40 cm) sowing and this was at par with T_4 (9.30 cm), T_5 (9.13 cm), T_6 (8.90 cm), T_7 (8.73 cm) and T_8 (8.53 cm) sowing. The pod length was shortest in the case of T_1 (7.37 cm) sowing. Pod length was negatively but significantly correlated with mean maximum temperature during 40 DAS-60 DAS (r^2= -0.761), flowering to harvest (r^2= -0.849) and with the mean minimum temperature recorded during the period of 40 DAS to 60 DAS (r^2= -0.746), flowering to harvest (r^2= -0.899) and sowing to harvesting (r^2= -0.769) as well as with average bright sunshine hrs. (r^2 = -0.722). Under Punjab conditions, Randhir *et al.* (1996) in a trial with an early maturing pea variety, observed that pod length and pods plant^{-1} from November planting were all superior to those from an October planting. This could be attributed to the low maximum temperature experienced between the period from flowering to maturity, which encounters milder temperatures, develops more slowly, grows for longer periods of time intercepts more solar energy and subsequently assimilates more photosynthates towards pod and seed development (Bhandari et al., 2016; Sita et al., 2017; Haq & Ahmed, 2021).

The weight of 10 pods of vegetable pea was highest for T_4 (75.67 g) sowing, which was statistically at par with T_5 (74.03 g), T_3 (70.03 g) and T_6 (67.17 g) and was significantly lowest for T_1 (50.33 g) sowing. 10 pods weight of vegetable pea was found to have a significant negative correlation with average bright sunshine hour (r^2= -0.771) during 40 DAS to 60 DAS as well as with mean maximum (r^2= -0.896), minimum temperature (r^2= -0.920) and average bright sunshine hrs. (r^2= -0.901) during flowering to harvest phase. In T_4 sowing shelling percentage was maximum (54.18%), which was statistically equivalent to T_5 (53.64%), T_3 (52.65%), T_6 (49.42%) and T_2 (47.86%), while T_1 sowing recorded the lowest (44.07%)

Table 3: Influence of different sowing dates on pod yield and its attributing parameters

Treatments	*Number of green pods per plant*	*Pod length (cm)*	*10 Pods weight (cm)*	*Shelling percentage*	*Pod yield (q/ha)*
T_1	12.00	7.37	50.33	44.07	39.62
T_2	13.73	8.00	56.33	47.86	43.47
T_3	16.33	9.40	70.03	52.65	48.79
T_4	20.80	9.30	75.67	54.18	52.06
T_5	18.23	9.13	74.03	53.64	51.01
T_6	15.43	8.90	67.17	49.42	48.39
T_7	14.33	8.73	65.83	45.53	44.53
T_8	12.97	8.53	52.43	45.88	41.66
Mean	15.47	8.67	63.97	49.15	46.19
SE(m)±	1.06	0.40	3.07	2.28	2.31
CD(p≤0.05)	3.23	1.22	9.30	6.91	6.99
CV	11.91	8.04	8.30	8.03	8.65

Table 4: Correlation of mean maximum temperature during different periods of crop growth with pod yield and its attributing parameters

Parameters→ / *Growth phases↓*	*Number of Green Pods per Plant*	*Pod Length (cm)*	*10 Pods Weight (g)*	*Shelling Percentage*	*Pod Yield (q/ha)*
Sowing-Seedling Establishment	0.109	-0.279	0.010	0.231	0.074
Sowing-20DAS	0.096	-0.294	-0.002	0.224	0.052
20 DAS-40DAS	-0.029	-0.383	-0.173	0.101	-0.112
40 DAS-60DAS	-0.508	-0.761*	-0.673	-0.407	-0.618
Sowing-First Flowering	0.038	-0.346	-0.101	0.151	-0.046
Flowering-Harvest	-0.833*	-0.849**	-0.896**	-0.773*	-0.901**
Sowing-Harvest	-0.366	-0.659	-0.490	-0.257	-0.452

(*at 0.05 level of significance and **at 0.01 level of significance)

Table 5: Correlation of mean minimum temperature during different periods of crop growth withpod yield and its attributing parameters

Parameters→ / *Growth phases↓*	*Number of Green Pods per Plant*	*Pod Length (cm)*	*10 Pods Weight (g)*	*Shelling Percentage*	*Pod Yield (q/ha)*
Sowing-Seedling Establishment	-0.265	-0.638	-0.422	-0.153	-0.347
Sowing-20DAS	-0.275	-0.647	-0.433	-0.168	-0.376
20 DAS-40DAS	-0.525	-0.663	-0.561	-0.419	-0.564
40 DAS-60DAS	-0.272	-0.746*	-0.443	-0.358	-0.417
Sowing-First Flowering	-0.336	-0.675	-0.471	-0.250	-0.436
Flowering-Harvest	-0.858**	-0.899**	-0.920**	-0.827*	-0.929**
Sowing-Harvest	-0.460	-0.769*	-0.594	-0.386	-0.562

(*at 0.05 level of significance and **at 0.01 level of significance)

for the same. Shelling percentage exhibited a negative but significant correlation with mean maximum temperature (r^2= -0.773), minimum temperature (r^2= -0.827) as well as average bright sunshine hrs. (r^2= -0.934) recorded during the flowering to harvest period. This could be owed to better growth and development of pods as well as seeds under mild temperatures, which allowed proper translocation of photosynthates to storage organs (Lamichaney *et al.*, 2021; Haq & Ahmed, 2021). Pod yield was highest for T_4 (52.06 q/ha) and was equivalent with T_5 (51.01 q/ha), T_3 (48.79 q/ha)

Table 6: Correlation of average bright sunshine hours during different periods of crop growth with pod yield and its attributing parameters

Parameters→ / *Growth phases↓*	*Number of Green Pods per Plant*	*Pod Length (cm)*	*10 Pods Weight (g)*	*Shelling Percentage*	*Pod Yield (q/ha)*
Sowing-Seedling Establishment	0.594	0.569	0.705	0.628	0.682
Sowing-20DAS	0.414	0.234	0.497	0.542	0.515
20 DAS-40DAS	0.221	-0.232	0.026	0.295	0.087
40 DAS-60DAS	-0.622	-0.644	-0.771*	-0.439	-0.687
Sowing-First Flowering	0.335	-0.032	0.234	0.448	0.291
Flowering-Harvest	-0.916**	-0.693	-0.901**	-0.934**	-0.940**
Sowing-Harvest	-0.557	-0.722*	-0.629	-0.442	-0.607

(*at 0.05 level of significance and**at 0.01 level of significance)

and T_6 (48.39 q/ha), while lowest pod yield hectare^{-1}was obtained from T_1 (39.62 q/ha). Pod yield is directly affected by the number of branches plant^{-1}, number of pods plant^{-1}, pod length and pod weight, which in turn are influenced by the maximum and minimum temperature as well as bright sunshine hours prevailing during flowering to harvest period of the crop (Sita et al., 2017; Kuznetsov et al., 2020; Lamichaney et al., 2021; Haq & Ahmed, 2021).

Conclusion

The analysis indicated that sowing undertaken between T_3 (1st November) to T_6 (1st December) corresponds with a mean maximum temperature of 21.6 to 23.4°C, minimum temperature of 10.2 to 10.9°C and 0 to 4.8 hours of bright sunshine during flowering to harvest of crop showed better performance in terms of growth and pod yield attributing parameters in vegetable pea under North Bihar conditions.

Acknowledgment

None.

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सारांश

यह परीक्षण सब्जी मटर की आठ अलग-अलग बुवाई तिथियों, 12 अक्टूबर (टी-1) से 21 दिसंबर 2021 (टी-8) तक, प्रत्येक बुवाई तिथियों के बीच 10 दिनों के अंतराल पर, वाले तीन अनुकरण में किया गया था। विभिन्न विकास और फली उपज के मापदंडों पर किए गए अवलोकनों का सांख्यिकीय रूप से विश्लेशण किया गया और फसल वृद्धि के संबंधित चरणों के दौरान दर्ज किए गए औसत अधिकतम, न्यूनतम तापमान के साथ-साथ औसत तेज धूप के घंटों के साथ सहसंबंधित किया गया। परिणामों से पता चला कि अध्ययन के तहत मापदंड विभिन्न बुवाई तिथियों से काफी प्रभावित थे। टी-6 में अधिकतम पौधा स्टैंड (93.53 प्रतिशत) दर्ज किया गया, टी-3 में सबसे अधिक फली की लंबाई (9.40 सेमी) दर्ज की गई और टी-4 में बुआई के 60 दिन पर अधिकतम पौधे की ऊंचाई (83.77 सेमी), प्रति पौधे षाखाओं की संख्या (3.97), फूल आने पर प्रति पौधे गांठों की संख्या (26.13), प्रति पौधे हरी फलियों की संख्या (20.80), 10 फलियों का वजन (75.67 ग्राम), छिलका निकलने का प्रतिषत (54.18) के साथ-साथ फली की उपज (52.06 क्विंटल/हेक्टेयर) रही। इस बीच टी-7 में गांठों की संख्या का सबसे कम मूल्य और टी-1 में अन्य पैरामीटरों के लिए देखा गया। सहसंबंध विष्लेशण के अनुसार यह देखा गया कि पौधे की ऊंचाई (बुआई के 20 दिन और बुआई के 40 दिन पर) और प्रति पौधे गांठों की संख्या को छोड़कर, अन्य सभी मापदंडो ने विचाराधीन मौसम संबंधी सूचकांकों के साथ नकारात्मक जुड़ाव दिखाया।