ISSN Print: 2664-6552
ISSN Online: 2664-6560
Impact Factor: RJIF 5.5
IJCRD 2022; 4(1): 15-20
https://www.chemicaljournal.in/
Received: 27-04-2022
Accepted: 16-05-2022

Shandhini J
Department of Agronomy, College of Agriculture, Central Agricultural University, Imphal, Manipur, India

K Nandini Devi
Department of Agronomy, College of Agriculture, Central Agricultural University, Imphal, Manipur, India

Diana Shamurailatpam
Department of Agronomy, College of Agriculture, Central Agricultural University, Imphal, Manipur, India

A Herojit Singh
Department of Agronomy, College of Agriculture, Central Agricultural University, Imphal, Manipur, India

N Gopimohan Singh
Department of Agronomy, College of Agriculture, Central Agricultural University, Imphal, Manipur, India

Saithala Mounika
Department of Agronomy, College of Agriculture, Central Agricultural University, Imphal, Manipur, India

Ganjare Rupesh
Department of Agronomy, College of Agriculture, Central Agricultural University, Imphal, Manipur, India

Corresponding Author:
Shandhini J
Department of Agronomy, College of Agriculture, Central Agricultural University, Imphal, Manipur, India

Effect of foliar application of potassium nitrate on yield and energy of garden pea (*Pisum sativum* L.)

Shandhini J, K Nandini Devi, Diana Shamurailatpam, A Herojit Singh, N Gopimohan Singh, Saithala Mounika and Ganjare Rupesh

Abstract
Field experimentation was conducted during *Rabi* season of 2021 at Central Farm, College of Agriculture, Central Agricultural University, Imphal, India to evaluate the "Effect of foliar application of potassium nitrate on growth, yield and economics of Garden pea (*Pisum sativum* L)". Experiment was laid out in Factorial Randomized Block design (FRBD) with three replications consisting of different times of foliar application (A_1: Flower initiation stage, A_2: Pod development stage and A_3: both stages) and four different levels of KNO_3 foliar application (F_1:0.5 % KNO_3, F_2:1 % KNO_3, F_3:1.5 % KNO_3 and F_4:2 % KNO_3) and one control with a total 13 treatments. The results of the study revealed that, among the various treatment combinations, the treatment (A_3F_4) foliar spray of 2% KNO_3 at both flower initiation and pod development stage recorded significantly highest yield components like number of pods per plant, number of seeds per pod, green pod yield, seed yield and Stover yield but non-significant in pod length and harvest index. It was followed by 1.5% KNO_3 application at both flower initiation and pod development stage. The assessment of the energy requirement of foliar application of potassium nitrate, the results revealed that the total input energy utilization was highest in 2% KNO_3 application at both flower initiation and pod development stage (A_3F_4) followed by 1.5 % KNO_3 at both flower initiation and pod development stage (A_3F_3). Maximum output energy (75.726 GJ/ha), net energy output (68.839 GJ/ha), energy productivity (0.3885 kg/MJ) and minimum specific energy (2.57 MJ/kg) were found in same treatment (A_3F_4). But in case of energy use efficiency (11.328 %) was found highest in 2 % KNO_3 application at flower initiation stage (A_1F_4).

Keywords: Garden pea, KNO_3, Foliar application, Input energy utilization, Energy output and Net energy.

Introduction
Pulses are excellent source of protein as well as wide range of vitamins and minerals. They are recognized as an important component of a balanced and healthy diet as evidenced by their use by the World Food Programme and other food aid initiatives. India has made a remarkable progress in enhancing the production of pulses during the past 15 years. During 2005-06, the total production of pulses in India was 13.38 million MT, which had increased to 25.58 million MT during 2020-21 (Pooran Gaur, 2021) [16]. Pea is a member of the family Leguminosae. Pea is one of the important pulse crops in India, grown during *Rabi* season. In many parts of the world, Pea is grown as a cold season crop, depending on location, its planting can take place from winter to early summer. It is an annual vine with determinate (bush type) or indeterminate type of climbing habit. Pea seeds are well known for their pivotal nutrients that can be differentiated in mainly soluble and insoluble fibre, protein, complex carbohydrates, vitamin B, calcium, potassium, iron but have a low content of saturated fat, Cholesterol and sodium. It possesses various health benefits by lessening the prevalence of colon cancer, upbringing type-2 diabetes, coronary diseases and LDL-cholesterol (Kour *et al.*, 2020; Roy *et al*., 2010) [11, 18].
India is the second largest producer of green peas after China. The annual global production of green pea and dry pea seeds are approximately 14.5 million tonnes and 22 million tonnes, respectively (Mondor, 2020) [12]. Among different countries, India shares 21.04 % of the world's total production of peas. The other major green pea producing countries are the U.S.A., France and Egypt. In India, Pulses occupy an area of 0.76 million hectares and producing 0.67 million tonnes.

Among different pulses in the country, Pea ranked in the seventh position and is commercially grown during *Rabi* season in an area of 568 thousand hectares, producing 5848 thousand metric tonnes with productivity of 9.6 metric tonnes/hectare (Jagdish Singh *et al.* 2021) [9].

Foliar application or foliar feeding is a technique of feeding plants with water soluble fertilizer of suitable concentration directly to plant leaves and absorbed through the plant's stomata. Foliar application of both essential nutrients and micro nutrients also plays a vital role in pulse production by stimulating root development, nodulation, energy transformation, various metabolic processes, translocation activity in plants and increasing pod setting and thereby increasing the yield. Foliar application has been shown to avoid the problem of leaching-out in soil and prompts a quick reaction in the plants. Foliar fertilizer act more quickly and far more effectively, as most of the fertilizer ends up in the plant, rather than in the soil. Foliar application is an effective method for quickly solving nutrient problems appearing in plants.

Potassium nitrate is a water-soluble inorganic salt with chemical formula KNO_3. Potassium nitrate is an outstanding source of potassium and nitrogen which has been used as a constituent for several different purposes like fertilizer as it contains main macronutrients that are taken up by the plants in comparatively large quantities. Potassium nitrate makes a plant more drought-resistant by regulating the opening and closing of stomata in the plant system and maintaining the turgidity of plant cells during drought conditions. Potassium minimizes plant transpiration and thereby reduces its water requirements. Potassium nitrate is an important nutrient for plant meristematic growth and physiological function, including protein synthesis, enzymes activation, photosynthesis and carbohydrate translocation in plants and it is also important in growth and quality of pea. Potassium nitrate also improves water use efficiency. Foliar fertilization is a widely used crop nutrition strategy of increasing importance in worldwide.

Materials and Methods

Site and Climatic

A Field experiment was conducted during Rabi season of 2019 at Research Farm, College of Agriculture, Central Agricultural University, Imphal. The site is located at 24^0 45 N' latitude and 93^0 56' E longitudes and at altitude of 790 m above the mean sea level and categorized in sub- tropical condition. The rainy season usually starts from April and it extends up to September and retreats from October onward. During the period of growing season, minimum temperature was found to be 7.3 ^oC in the month of February and maximum temperature (29.4 ^oC) in the month of March. The total rainfall received 208.2 mm and relative humidity was 86.9 % during experimental period.

Experimental Details

A Field experiment was conducted during Rabi season of 2019 at Research Farm, College of Agriculture, Central Agricultural University, Imphal. The soil of the experimental field was high in organic carbon (1.17 %), medium in available nitrogen (316.68 kg/ha), low in available phosphorus (16.8 kg/ha) and medium in available potassium (267.83 kg/ha) with slightly acidic (pH 5.25) in reaction. Experiment was laid out in Factorial Randomized Block design (FRBD) with three replications consisting of different times of foliar application (A_1: Flower initiation stage, A_2: Pod development stage and A_3: both stages) and four different levels of KNO_3 foliar application (F_1:0.5% KNO_3, F_2:1 % KNO_3, F_3:1.5 % KNO_3 and F_4:2 % KNO_3) and one control with a total 13 treatments. The crop was sown as line sown with seed rate of 80 kg/ha on 27th November, 2021. A common fertilizer dose of 20, 40 and 30 kg of N, P_2O_5 and K_2O per ha, respectively were applied one day prior to sowing. The crop was harvested on 16th March, 2022. The data obtained from the experiment were subjected to statistical analysis by adopting analysis of variance technique for "Factorial Randomized Block Design". Significance of difference among the treatment effect was tested through "F" test and critical difference (CD) was calculated, wherever, the results were found significant. To elucidate the nature and magnitude of treatment effects, tables along with S.E.M. and C.D. were calculated at 5 % level of significance.

Results and Discussion

Effect of foliar application of potassium nitrate on yield attributes

The result pertaining to the number of pods, number of seeds per pod and pod length (cm) were furnished in the Table 1, 2 and 3. The maximum number of 17.18 pods per plant was found in 2 % KNO_3 application and it was significantly superior to over 0.5%, 1 % and 1.5 % KNO_3 application. In term of different time of foliar application, maximum number of pods (17.25) was recorded with KNO_3 application at both flower initiation and pod development stage. The significantly highest order of interaction was observed (Table 3) in the treatment combination of 2% KNO_3 application at both flower initiation and pod development stage. The minimum number of pods was observed in control (10.27). The adequate availability of potassium and nitrogen were responsible for increased number of functional leaves, resulting in higher photosynthetic and assimilation rates, which consequently increased yield components like pods per plant. These results are conformity with those of Reddy *et al.* (2004) [17].

The seeds per pod in 2 % KNO_3 application was found 7.84 seeds per pod which significantly highest as compared to 0.5%, 1 % and 1.5 % KNO_3 application (Table 2). The significantly maximum number of seeds per pod (7.30) was recorded with the application of KNO_3 at both flower initiation and pod development stage (Sarrwy *et al.* 2010) [19]. Potassium nitrate might have improved pod filling and phytomass production due to increased photosynthetic activity and effective translocation of assimilates to reproductive parts. This result is in conformity with the earlier findings of Bibek *et al.* (2020) [1]. The significantly highest number of seeds per pod (9.03) was obtained in treatment combination of higher dose of KNO_3 (2%) application at both flower initiation and pod development stage. The lowest number of pods was observed in control (4.97). The remarkably highest pod length (9.53 cm) was observed in 2% KNO_3 application which significantly highest over other treatments (Table 2). The possible reason for enhancement in pod length might be due to higher synthesis of metabolites and enhanced mobilization of food and minerals from other parts of the plants towards developing pod as it is a well-established fact the pod acts as extremely active metabolic sink. Dhanoji (2011) [3] and Yadav *et al.* (2021) [21] also reported similar findings. In respect of time of application, KNO_3 application at both flower initiation and pod development stage was recorded highest pod length (9.10 cm). The non-significantly highest order of interaction was observed in the treatment combination of 2 % KNO_3 application at both flower initiation and pod development stage (10.13 cm). The minimum pod length was observed in control (6.80 cm) (Table 6).

Effect of foliar application of potassium nitrate on yield

The data (Table 3) on green pod yield (kg/ha) and seed yield (kg/ha) of garden pea as influenced by time and level of potassium nitrate foliar application significantly. A close observation of the data (Table 2) indicated that different level of potassium nitrate application had significant effect on green pod yield and seed yield of garden pea. The maximum green pod yield and seed yield per hectare were observed in 2 % potassium nitrate (F_4) foliar application and this was followed by 1.5 % potassium nitrate (F_3) application. The transport of assimilates thereby better balanced supply with cation and anions of potassium, nitrate nitrogen respectively enhance the other nutrient availability at critical stage could have induce more flowering, reducing in flower shedding and increased transportation of photosynthates from source to sink resulting increased green pod and seed yield of garden pea. El-Ashry and El-Kholy (2005) [5] also reported similar findings.

Regarding time of foliar application (Table 1), green pod yield and seed yield were highest in potassium nitrate application at both flower initiation and pod development stage (A_3) and minimum yield were observed in application of potassium nitrate at pod development stage (A_2). It could be due to the supplementation of balanced dose of fertilizer application through KNO_3 which improved vegetative and yield attributing character like plant height, number of branches, plant fresh and dry weight, number of pods, number of seeds, pod length which ultimately contributed to higher grain yield. These findings are also Srinivasarao *et al*. (2003) [20]. Interaction between time and level of potassium nitrate application were found to be significant for green pod yield and seed yield were found in 2 % KNO_3 application at both flower initiation and pod development stage and minimum yield were recorded in control. The results are in accordance with earlier finding of Ejaz *et al*. (2011) [4] and Jitendra Marskile *et al*. (2021) [10].

The data in Table 2 showed that different level of potassium nitrate application had significant effect on Stover yield of garden pea. The maximum Stover yield per hectare was observed in 2% potassium nitrate (F_4) application and this was followed by foliar application of 1.5% potassium nitrate (F_3). The minimum mean Stover yield was observed in 0.5% potassium nitrate (F_1) foliar application. Potassium nitrate plays a major role in growth as it is involved in assimilation, transport and storage tissue development and also improvement in crop yield due to chlorophyll synthesis, photosynthesis and in turn of accumulation of dry matter as Stover yield similar findings reported by Jabeen and Ahmad (2011) [8]. There was significant effect of time of potassium nitrate application on biological yield. The maximum Stover yield was observed in potassium nitrate application at both flower initiation and pod development stage (A_3) and the minimum Stover yield was observed in application of potassium nitrate at pod development stage (A_2). Higher Stover production might be due to enhanced vegetative growth of the crop. The results are in conformity with Gowthami *et al.* (2018) [6] and Jitendra Marskile *et al.* (2021) [10]. There was significant interaction effect between time and level of foliar application of potassium nitrate on Stover yield of garden pea. Better performance of Stover yield was observed in the combination of 2% potassium nitrate receiving at both flower initiation and pod development stage (A_3F_4) and the minimum Stover yield was observed in control.

The significantly highest harvest index (47.42%) was recorded (Table 2) in the 2% KNO_3 application and the lowest (43.41%) was recorded at 0.5% KNO_3 application. The harvest index highest with KNO_3 application at both flower initiation and pod development stage was observed (Table 4). It may be due to higher dry matter partitioning of photosynthates between grain and Stover of plant. The results are in conformity with Pal and Keorah (2012) [13]. The treatment receiving 2% KNO_3 application at both flower initiation and pod development stage non-significantly highest (49.73 %) was observed. The lowest harvest index was found in control (38.76 %).

Table 1: Effect of time of foliar application of potassium nitrate on yield and yield components of garden pea

Treatments	Number of pods per plant	Number of seeds per pod	Pod length (cm)	Green pod yield (kg/ka)	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest Index (%)
Flower initiation stage (A_1)	15.58	6.21	8.17	1080	829	2256	45.73
Pod development stage (A_2)	13.11	6.45	8.60	979	605	2101	42.86
Flower initiation and Pod development stage (A_3)	17.25	7.30	9.10	1210	1034	2454	47.61
S.E.M (±)	0.18	0.10	0.15	17.63	10.78	30.71	0.39
C.D (P =0.05)	0.51	0.30	0.43	51.36	31.41	89.46	1.12

Table 2: Effect of different level of potassium nitrate foliar application on yield and yield components of garden pea

Treatments	Number of pods per plant	Number of seeds per pod	Pod length (cm)	Green pod yield (kg/ka)	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest Index (%)
0.5% KNO_3 (F_1)	13.51	5.74	7.56	938	674	2088	43.41
1.0% KNO_3 (F_2)	14.52	6.12	8.39	1017	787	2198	44.89
1.5% KNO_3 (F_3)	16.04	6.90	9.01	1125	862	2329	45.90
2.0% KNO_3 (F_4)	17.18	7.84	9.53	1278	966	2467	47.42
S.E.M (±)	0.20	0.12	0.17	20.36	12.45	35.46	0.45
C.D (P =0.05)	0.59	0.34	0.50	59.31	36.27	103.30	1.30

Table 3: Effect of time and different level of potassium nitrate foliar application on yield and yield components of garden pea

Treatments	Number of pods per plant	Number of seeds per pod	Pod length (cm)	Green pod yield (kg/ka)	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest Index (%)
A1F1	14.07	5.47	7.17	956	658	2066	43.85
A1F2	15.00	5.87	8.06	1039	767	2187	45.28
A1F3	16.00	6.47	8.43	1105	882	2297	46.44
A1F4	17.27	7.03	9.00	1220	1008	2473	47.36
A2F1	11.77	5.73	7.50	853	507	1973	40.80
A2F2	12.47	6.00	8.40	906	579	2043	42.09
A2F3	13.80	6.60	9.03	1037	625	2168	43.40
A2F4	14.40	7.47	9.47	1120	711	2222	45.16
A3F1	14.70	6.03	8.01	1006	858	2226	45.57
A3F2	16.10	6.50	8.70	1106	1017	2366	47.28
A3F3	18.33	7.63	9.57	1233	1080	2521	47.85
A3F4	19.87	9.03	10.13	1496	1180	2705	49.73
Control	10.27	4.97	6.80	706	432	1800	38.76
S.E.M (±)	0.35	0.20	0.30	35.26	21.56	61.41	0.77
C.D (combination)	1.02	0.59	NS	102.72	62.82	178.92	NS
C.D (Interaction)	1.02	0.59	NS	102.72	62.82	178.92	NS

Energy Analysis

Energy input (GJ/ha)

Total energy used in different production processes for producing garden pea is shown in Table 4. Among the different treatment combination, the highest input energy (6.887 GJ/ha) was recorded treatment A_3F_4 which received in 2 % potassium nitrate application at both flower initiation and pod development stage followed by 1.5 % KNO_3 application at both flower initiation and pod development stage A_3F_3 (6.318 GJ/ha). The lowest energy input (4.613 GJ/ha) was recorded in control. The highest energy of chemical fertilizer (KNO_3) was used as compared to other treatments. These results are similar confirm with Hamedani *et al.* (2011) [7].

Energy output (GJ/ha)

Data prevailing that (Table 5) among the different treatment combination, the highest output energy (75.726 GJ/ha) was recorded treatment A_3F_4 which received in 2 % potassium nitrate application at both flower initiation and pod development stage. This was followed by 1.5 % KNO_3 application at flower initiation and pod development stage A_3F_3 (67.189 GJ/ha). This was due to use of appropriate amount of energy input used to produce more amount of energy output. Such variations in energy among different treatment were also reported by Pelesaraei *et al.* (2013) [15]. The lowest output energy (38.309 GJ/ha) was recorded in control.

Net energy output (GJ/ha)

The highest net energy output (68.839 GJ/ha) was recorded (as presented in the Table 4) treatment A_3F_4 which received 2 % potassium nitrate application at both flower initiation and pod development stage. This was followed by 1.5 % KNO_3 application at flower initiation and pod development stage A_3F_3 (60.870 GJ/ha). The lowest net energy output (33.696 GJ/ha) was recorded in control.

Energy use efficiency (%)

Among the different treatment the highest energy use efficiency (11.328 %) was recorded treatment A_1F_4 which received in 2 % potassium nitrate application at flower initiation stage followed by 2% KNO_3 application at flower initiation and pod development stage A_3F_4 (10.995 %). The lowest energy use efficiency (8.304 %) was recorded in control. It could be due to using low input energy in A_1F_4 treatment combination. Therefore our results indicate that the energy was used most efficiently in A_1F_4. Such variations in energy among different treatment were also reported by Pelesaraei *et al.* (2013) [15].

Energy productivity (kg/MJ)

Energy input and output, energy use efficiency, specific energy, energy productivity and net energy output are summarized in Table 5. Among the different treatment the highest energy productivity (0.3885 kg/MJ) was recorded treatment A_3F_4 which received in 2% potassium nitrate application at both flower initiation and pod development stage followed by 2 % KNO_3 application at flower initiation stage A_1F_4 (0.3875 kg/MJ). The lowest energy productivity (0.2467 kg/MJ) was recorded in control. This means that 0.3885 kg outputs were obtained per unit energy in garden pea cultivation. This observation was supported by Chaudhary *et al.* (2006) [2].

Specific energy (MJ/kg)

Among the different treatment the lowest specific energy (2.57 MJ/kg) was recorded treatment A_3F_4 which received in 2 % potassium nitrate application at both flower initiation and pod development stage followed by 2 % KNO_3 application at flower initiation stage A_1F_4 (2.58 MJ/kg). The highest specific energy (4.05 MJ/kg) was recorded in control. This observation was supported by Patil *et al.* (2013) [14].

Table 4: Energy equivalent of inputs and outputs in garden pea cultivation

S. No.	Particulars	Units	Equivalent Energy (MJ)
Input energy			
1	Machine	h	64.8
2	Human labour	h	1.96
3	Diesel	liter	56.31
4	N fertilizer	Kg	60.6
5	P fertilizer	Kg	11.1
6	K fertilizer	Kg	6.7
7	Potassium nitrate	Kg	68.2
8	Seeds	Kg	18.8
Output Energy			
1	Seeds	Kg	18.8
2	Stover	Kg	9.4

Table 5: Energy of garden pea cultivation as influenced by foliar application of potassium nitrate (KNO_3)

Treatments	Total energy for Input (GJ/ ha)	Energy for Output (GJ/ ha)	Net energy output (GJ /ha)	Energy Use Efficiency (%)	Energy Productivity (Kg/MJ)	Specific Energy (MJ/ kg)
A1F1	4.902	49.755	44.853	10.151	0.3292	3.04
A1F2	5.181	54.499	49.318	10.518	0.3485	2.87
A1F3	5.466	58.945	53.479	10.784	0.3635	2.75
A1F4	5.750	65.137	59.386	11.328	0.3875	2.58
A2F1	4.902	44.110	39.208	8.999	0.2775	3.60
A2F2	5.181	47.109	41.927	9.092	0.2865	3.49
A2F3	5.466	51.629	46.163	9.446	0.3041	3.29
A2F4	5.750	55.301	49.551	9.617	0.3184	3.14
A3F1	5.190	55.950	50.760	10.780	0.3590	2.79
A3F2	5.749	62.134	56.384	10.807	0.3691	2.71
A3F3	6.318	67.189	60.870	10.634	0.3661	2.73
A3F4	6.887	75.726	68.839	10.995	0.3885	2.57
Control	4.613	38.309	33.696	8.304	0.2467	4.05

*T_1 - 0.5 % KNO3 at flower initiation stage; T_2 – 1 % KNO3 at flower initiation stage; T_3 - 1.5 % KNO3 at flower initiation stage
T_4 – 2 % KNO3 at flower initiation stage; T_5 - 0.5 % KNO3 at pod development stage; T_6 – 1 % KNO3 at pod development stage
T_7 - 1.5 % KNO3 at pod development stage; T_8 – 2 % KNO3 at pod development stage;
T_9 - 0.5 % KNO3 at Flower Initiation + Pod Development stage; T_{10} – 1 % KNO3 at Flower Initiation + Pod Development stage; T_{11} - 1.5 % KNO3 at Flower Initiation + Pod Development stage; T_{12} - 10.5 % KNO3 at Flower Initiation + Pod Development stage; T_{13} – Control

Conclusion

On the basis of the results obtained from the present investigation it could be concluded that 2% KNO_3 application at both flower initiation and pod development stage (A_3F_4) achieved higher values with regards to yield and yield attributes (number of pods/plant, number of seeds per pod, green pod yield, seed yield, Stover yield). The maximum energy input, energy output, net energy output, energy productivity and minimum specific energy were observed in treatment combination which receiving 2% KNO_3 application at both flower initiation and pod development stage (A_3F_4). The maximum energy use efficiency was observed in 2% KNO_3 application at flower initiation alone (A_1F_4). The minimum energy input, energy output, net energy output, energy productivity and maximum specific energy were found in control.

Acknowledgment

Authors are thankful to Dean, College of Agriculture, Central Agriculture University, Imphal, Manipur for providing all the necessary facilities required for conducting the experiment.

References

1. Bibek L, Basanta ST, Kalpana A, Merinda W, Sunil, Jiten SW. Effect of salicylic acid and potassium nitrate on growth and yield of lentil (*Lens culinaris* L.) under rain fed condition. Int. J. Curr. Microbiol. App. Sci. 2020;9(11):2779-2791.
2. Chaudhary VP, Gangwar B, Pandey DK. Auditing of energy use and output of different cropping systems in India. Agric. Eng. Int: CIGR J. 2006 Jun 1;8:1-14.
3. Dhanoji MM. Influence of foliar spray of seed hardening chemicals on growth and yield of chickpea (*Cicer arietinum* L.). Environ. Ecol. 2011;29(2A):903-90.
4. Ejaz Ahmad Waraich, Ahmad R, Raja GM, Ehsanullah Ahmad A, Nasir Mahmood. Response of foliar application of KNO_3 on yield, yield components and lint quality of cotton (*Gossypium hirsutum* L.). Afr. J. Agric. Res. 2011 Oct 26;6(24):5457-5463.
5. EL-Ashry SM, El-Kholy MA. Response of wheat cultivars to chemical desiccants under water stress conditions. J. Appl. Sci. Res. 2005;1(2):253-262.
6. Gowthami P, Rama Rao G, Rao KLN, Lal Ahamed M. Influence of foliar application potassium, boron and zinc on growth and yield of soybean. Int. J. Chem. Stud. 2018;6(1):142-144.
7. Hamedani SR, Keyhani A, Alimardani R. Energy use patterns and econometric models of grape production in Hamadan province of Iran. Energy. 2011;36:6345-6351.
8. Jabeen N, Ahmad R. Foliar application of potassium nitrate affects the growth and nitrate reductase activity in Sunflower and Safflower leaves under salinity. Not. Bot. Horti. Agrobo. 2011 Nov 21;39(2):172-178.
9. Jagdish Singh, Behara TK, Singh AK. Horticulture and nutrition: Two sides of the coin. Indian J. Hortic. 2021;66(5):37-40.
10. Jitendra Marskile VD, Dwivedi SB, Agrawal NK, Bisen, Uttam Bisen. Effect of different agro chemicals on growth, development and yield of soybean (Glycine max L.) under rainfed conditions. Int. J. Curr. Microbiol. App. Sci. 2021;10(7):765-769.
11. Kour J, Nayik GA, ul Haq R, Anand N, Alam MS, Ramaiyan B, *et al*. Pea. In: Antioxidants in Vegetables and Nuts Properties and Health Benefits (pp. 3-17). Singapore: Springer, 2020.
12. Mondor M. Pulses. In: Pea (pp. 245-273). Cham: Springer, 2020.
13. Pal AK, Keorah B. Pre-sowing seed treatment and foliar spray of nitrate salts on yield of summer green gram [*Vigna radiata* (L) Wilczek] in alluvial soil of West Bengal. Crop Res., (Hisar). 2012;44(1/2):42-44.
14. Patil SL, Mishra PK, Loganandhan N, Ramesha MN, Math SKN. Energy, economics and water use efficiency of chickpea (*Cicer arietinum* L.) cultivars in Vertisols of semi-arid tropics, India. Curr. sci. 2013;107(4):25.
15. Pelesaraei AN, Sadeghzadeh A, Payman MH, Mobtaker HG. Energy flow modeling, economic and sensitivity analysis of eggplant production in Guilan province of Iran. Int. J. Agric. Crop Sci. 2013;5(24):3006-3015.
16. Pooran Gaur. Can India sustain high growth of pulses production?. J. Food Legum. 2021;34(1):1-3.

17. Reddy PK, Narasimha Rao L, Narasimha Rao CL, Mahalakshmi BK. Effect of different chemicals on growth, yield and yield attributes of pigeon pea in Vertisol. J. Plant Physiol. 2004;17(2):120-124.
18. Roy F, Boye JI, Simpson BK. Bioactive proteins and peptides in pulse crops: Pea, chickpea and lentil. Food Res. Int. 2010;43(2):432-442.
19. Sarrwy SMA, Mohamed EA, Hassan HSA. Effect of foliar spray with potassium nitrate and mono-potassium phosphate on leaf mineral contents, fruit set, yield and fruit quality of Picual olive trees grown under sandy soil conditions. American Eurasian J. Agric. Environ. Sci. 2010;8(4):420-430.
20. Srinivasarao C, Masood A, Ganeshamurthy AN, Singh KK. Potassium requirements of pulse crops. Better crops Int. 2003;17(1):8-11.
21. Yadav RK, Manendra Kumar, Pradip Kumar Saini, Alok Kumar Singh, Singh AK, Brijesh Kumar, *et al*. Effect of foliar application of different nutrients on growth and yield of wheat (*Triticum aestivum* L.) under sodic soil. J. Pharm. Innov. 2021;10(1):589-594.