

Short communication

## Heat unit requirement of garden pea

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Garden pea is an important and nutritious legume vegetable grown widely throughout the world and is a rich and cheap source of protein, this carries great importance for the developing countries like India. India is the highest producer of garden pea with a chunk of 33.6% to the world production (Negi and Mitra, 1999). Garden pea is adapted to a cool and moist climate within a temperature range of 7-21°C, the optimum being 18-21°C. As temperature has a significant impact on growth, development and quality of pods, several farmers use a system of accumulated degree days or heat units to determine dates of planting and to schedule subsequent harvesting and processing of peas (Despande and Adsule, 1998). Very few attempts have been made in Indian condition to relate the accumulated heat units with different phenophases of this particular crop. Keeping this in view, 30 garden pea genotypes were chosen to determine heat unit requirements.

The experimental material comprising 30 garden pea genotypes of indigenous and exotic origin, were grown on the research farm of IARI, New Delhi during *rabi* season of 1997-98 (Date of sowing : 18<sup>th</sup> Nov, 1997). The experiment was laid out in a rectangular lattice design (Cochran and Cox, 1957) with three replications. Recommended cultural practices were adopted for raising the crop. Ten plants each were

randomly selected and observations recorded for fifteen quantitative characters.

For the important phenological stages, different thermal indices viz. growing degree days (GDD), heliothermal units (HTU) and photothermal units (PTU) were calculated. Growing degree days were computed by taking a base temperature of 4.4°C (Despande and Adsule, 1998). Photothermal units were computed by multiplying the GDD with day length. The heliothermal units were calculated by multiplying the GDD with actual sunshine hours (Chakravarty and Sastry, 1983).

The number of days taken for appearance of first flower varied from 57 to 79 in case of early genotypes, 78 to 86 for mid season and 79 to 92 days for late genotypes. Among all the genotypes, the earliest to flower was Cv. GP-17 (57 days) and the latest being GP-6 (92 days). As compared to the first two stages, much variation was observed among the genotypes for the first green pod harvest stage. Even with same number of days for first flower appearance, there was marked difference with respect to first green pod harvest. Early genotypes took 100 to 113 days for first green pod harvest, the earliest being Arkel. For the other group of genotypes the range was less; the values being 113 to 117 days for mid - season and 118 to 122 days for late genotypes (Table 1).

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**Table 1:** Number of days and GDD taken to reach different phenological events (from sowing) in garden pea.

Genotypes	Number of days to reach phenological events			GDD requirement for phenological events		
	First flowering	50% flowering	First green pod harvest	First flowering	50% flowering	First green pod harvest
<b>Early</b>						
Arkel	62	64	100	612	626	1018
GP-3	73	74	111	693	704	1159
GP-4	75	76	107	716	728	1103
GP-17	57	58	107	563	575	1103
GP-24	78	79	113	755	766	1183
GP-35	79	84	111	766	812	1159
GP-41	70	72	106	664	680	1088
<b>Medium</b>						
GP-1	78	81	117	755	785	1244
GP-14	85	86	114	822	832	1195
GP-15	78	81	113	755	785	1183
GP-16	83	84	116	802	812	1229
GP-25	81	82	116	785	793	1229
GP-27	79	81	113	766	785	1183
GP-34	86	90	115	832	883	1213
GP-36	82	84	113	793	812	1183
GP-42	79	81	113	766	785	1183
GP-393	85	86	116	822	832	1229
JP-83	85	88	114	822	854	1195
<b>Late</b>						
GP-2	87	87	118	843	843	1259
GP-6	92	93	120	913	928	1289
GP-12	84	85	118	812	822	1259
GP-26	79	81	119	766	785	1274
GP-33	87	87	118	843	843	1259
GP-37	85	86	118	822	832	1259
GP-201	84	85	122	812	822	1321
GP-394	85	87	119	822	843	1274
GP-395	85	86	120	822	832	1289
GP-396	84	87	119	812	843	1274
GP-397	83	85	118	802	822	1259
JP-585	89	91	118	866	898	1259
CD 5%	2.04	1.05	1.45	20.6	10.6	20.3
CD 1%	2.73	1.40	1.94	27.6	14.1	27.2

**Table 2:** Heliothermal and photothermal units for different phenological events (from sowing) in garden pea.

Genotypes	HIU			PTU		
	First flowering	50% flowering	First green pod harvest	First flowering	50% flowering	First green pod harvest
<b>Early</b>						
Arkel	1864	1941	3971	6426	6576	10901
GP-3	2202	2260	4617	7281	7393	12561
GP-4	2270	2321	4328	7522	7659	11893
GP-17	1538	1630	4328	7522	7659	11893
GP-24	2358	2455	4859	7953	8085	12845
GP-35	2455	2842	4617	8085	8592	12561
GP-41	2143	2198	4327	6969	7145	11716
<b>Medium</b>						
GP-1	2358	2618	5288	7953	8289	13575
GP-14	2912	2976	4967	8703	8816	12999
GP-15	2358	2618	4859	7953	8289	12845
GP-16	2755	2842	5150	8483	8592	13396
GP-25	2618	2690	5150	8289	8384	13396
GP-27	2455	2618	4859	8085	8289	12845
GP-34	2976	3183	5063	8816	9393	13215
GP-36	2690	2842	4859	8384	8592	12845
GP-42	2455	2618	4859	8085	8289	12845
GP-393	2913	2976	5150	8703	8816	13396
JP-83	2913	3140	4967	8703	9066	12999
<b>Late</b>						
GP-2	3062	3062	5394	8938	8938	13756
GP-6	3309	3413	5577	9723	9887	14118
GP-12	2842	2913	5394	8592	8703	13756
GP-26	2455	2618	5499	8085	8289	13936
GP-33	3062	3062	5394	8938	8938	13756
GP-37	2913	2976	5394	8703	8816	13756
GP-201	2842	2913	5891	8592	8703	14504
GP-394	2913	3062	5499	8703	8938	13936
GP-395	2913	2976	5577	8703	8816	14118
GP-396	2842	3062	5499	8592	8938	13936
GP-397	2755	2913	5394	8483	8703	13756
JP-585	3176	3293	5394	9196	9559	13756
CD 5%	102.0	52.5	150.8	224.4	115.5	239.2
CD 1%	136.5	70.0	201.8	300.3	154.0	320.1

Table 3: Mean values for different quantitative characters in 30 genotypes of garden pea

Genotype pea	1 <sup>st</sup> flower node No.	Internode length (cm)	Pod length (cm)	Breadth of pod (cm)	Seeds per pod	Pods/plant	Pod yield/plant (g)	Seed yield/plant (g)	Plant height (cm)	100 seed weight (g)	Shelling (%)	Protein content (%)
<b>Early</b>												
Arkel	8.4	4.0	7.5	1.2	5.2	25.6	89.0	46.6	74.4	16.9	41.0	27.4
GP-3	11.7	5.2	7.1	1.2	4.3	35.2	66.1	28.2	97.9	12.4	35.9	24.3
GP-4	12.5	6.0	7.6	1.3	4.1	19.3	58.8	24.9	95.4	16.9	40.7	25.0
GP-17	8.2	4.5	7.2	1.2	4.4	28.0	82.5	40.1	83.9	20.2	42.0	27.7
GP-24	11.3	4.7	6.2	1.3	4.1	29.2	52.6	28.3	103.0	11.6	53.2	22.7
GP-35	14.7	11.9	5.5	1.2	3.6	42.5	57.5	29.0	241.2	14.4	47.8	23.7
GP-41	11.4	3.2	6.1	1.3	1.8	28.3	57.6	20.4	85.2	33.7	35.9	25.0
<b>Medium</b>												
GP-1	13.8	3.8	6.8	1.3	4.3	20.4	48.8	26.9	89.9	17.0	49.8	22.6
GP-14	11.0	5.7	7.3	1.3	4.2	70.7	134.4	54.9	101.5	13.7	39.4	22.3
GP-15	14.1	9.1	5.7	1.1	4.5	25.4	33.5	20.6	181.6	10.8	45.7	23.6
GP-16	15.6	6.2	7.4	1.2	5.0	39.0	118.6	47.2	94.5	16.0	47.8	27.0
GP-25	12.1	4.6	6.3	1.2	4.1	32.3	64.1	42.0	95.6	11.5	44.7	23.4
GP-27	12.4	4.5	5.7	1.1	3.8	54.5	65.4	40.4	85.1	11.5	43.7	23.6
GP-34	16.9	11.3	5.3	1.2	4.0	41.8	57.6	32.4	201.2	12.5	47.4	20.9
GP-36	16.6	12.1	5.7	1.2	3.8	33.6	40.5	20.9	249.0	15.6	44.8	23.1
GP-42	13.0	11.6	6.4	1.3	3.3	20.2	40.2	13.9	220.5	21.0	35.5	19.4
GP-393	17.7	12.5	6.6	1.3	4.0	42.2	77.6	41.4	257.2	17.8	46.2	22.2
JP-83	14.1	5.3	6.6	1.2	4.3	34.1	70.4	41.5	77.9	15.9	51.2	24.3
<b>Late</b>												
GP-2	16.4	5.6	7.5	1.2	5.4	32.9	95.0	55.2	104.4	14.4	49.4	27.3
GP-6	16.4	2.8	6.1	1.1	4.8	16.6	31.5	17.4	57.0	15.2	44.9	22.6
GP-12	14.7	7.8	5.3	1.0	2.6	42.8	52.6	29.2	113.0	13.6	46.6	20.9
GP-26	11.6	4.3	5.7	1.0	3.6	41.0	61.5	24.8	80.2	9.4	44.3	26.2
GP-33	15.0	13.0	6.2	1.2	4.2	39.3	78.9	44.0	248.8	15.5	46.0	27.8
GP-37	15.1	7.9	5.5	1.1	2.7	56.5	60.8	29.6	117.2	12.7	43.1	29.8
GP-201	14.8	7.4	5.3	1.0	2.9	35.4	41.7	23.6	111.2	13.0	48.4	25.5
GP-394	15.1	7.3	5.3	1.0	2.7	58.6	75.8	43.4	114.6	14.4	45.8	24.5
GP-395	14.5	6.4	5.3	1.0	2.7	38.7	53.0	29.9	99.1	11.3	50.8	28.5
GP-396	15.7	5.1	5.5	1.1	3.3	53.8	75.3	42.4	91.6	14.2	51.4	25.5
GP-397	16.0	5.5	6.5	1.3	4.4	40.2	85.4	49.3	90.5	17.8	51.8	26.9
JP-585	14.6	3.8	6.6	1.3	4.4	32.9	82.7	46.1	74.9	14.2	47.7	24.5
CD 5%	0.52	0.32	0.02	0.001	0.06	8.97	47.27	16.48	57.39	0.10	1.29	0.52
CD 1%	0.70	0.43	0.03	0.001	0.08	11.99	63.18	22.03	76.71	0.13	1.73	0.70

The GDD required to reach the first flower was 755-832 day °C for most of the genotypes. However, it was the lowest in GP-17 (563 day°C) and highest in GP-6 (913 day°C). The heliothermal unit requirement at first green pod harvest stage varied from 3971-4859 for early genotypes, 4859 - 5288 for mid season and 5394-5851 day°C hours for late genotypes (Table 2)

The first flowering node number of early genotypes was between 8 to 12 where as for mid and late genotypes, it ranged from 11 to 18 (Table 3). In general, it was observed that genotypes having lower first flowering node came to flower first and almost matured early. Out of the GDD and yield data of the 30 genotypes, it can be observed that a number of genotypes with same GDD requirement have differed widely in the yield. For instance JP-585 and GP-37 even though have taken same GDD, the yield per plant for the two genotypes are 46.1 and 29.6 g respectively. Another interesting observation is that the genotype that took the lowest GDD among the 30 genotypes studied, had shown significantly higher yield than the genotype that took the highest GDD (Arkel with 1018 day °C and yield of 46.4 g plant<sup>-1</sup> as

compared to GP-201 with 1321 day°C and yield of 23.9 g plant<sup>-1</sup>). In general for seasonal crops GDD and yield have high positive correlation. However, the study of 30 genotypes in case of garden pea has shown that the relation is not found in this crop. Instead of GDD, yield in this crop is more related to length of internode.

### REFERENCES

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