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## Effect of variable weather parameters on seed quality of cauliflower (*Brassica oleracea* Var *Botrytis* L.) in three locations of Solan district of Himachal Pradesh

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### Abstract

Seed quality may affect the seed germination and seed vigour index of the crop. The present investigation was carried out to study the impact of various weather parameters on germination percentage, seedling dry weight, seedling vigor index-I and seedling vigor index-II, of seeds collected from Nauni, Saproon and Kandaghat in Solan district of Himachal Pradesh during 2014-15 and 2015-16. Seed quality for different seeds from three locations were evaluated in the laboratory by measuring Germination percentage (%), Root length (cm) Shoot length (cm) Seedling fresh weight (g) Seedling dry weight (g), Viability of seed (%), Electrical conductivity, Vigour index I and Vigour index II. The highest germination percentage was recorded at Saproon (86.9), followed by Kandaghat (83.2) and lowest was recorded at Nauni (70.7). Maximum root length was recorded at Saproon (5.64cm), followed by Kandaghat (5.44cm) and lowest at Nauni (3.94cm). Maximum seedling fresh and dry weights, were also recorded at Saproon (0.334g, 0.054g, respectively and minimum at Nauni (0.266g, 0.040g, respectively). The statistically highest seed viability was recorded at Saproon, (97.57%) followed by Kandaghat (96.28%) and lowest at Nauni (91.37%). The highest vigour index -I (655.89) was recorded at Kandaghat during 2014-15 and lowest (381.8) at Nauni in vigour index-II were recorded 2014-2015.

**Keywords:** Cauliflower, seed crop, location, germination and vigour

### Introduction

Cauliflower (*Brassica oleracea* var. *botrytis* L.) is one of the most important vegetable in India and belongs to the family cruciferae. Cauliflower (*Brassica oleracea* var. *botrytis* L.) holds an important position among the vegetable crops and there is a great demand of this vegetable throughout the year, but the production of cauliflower is poor due to non availability of quality seed of recommended varieties. High quality seeds is essential and desirable to ensure good crop establishment for many field crops; one of the main problem observed in the field i.e. poor seedling stand establishment which is influenced by seed quality, adverse climatic conditions and poor field management. Cauliflower is cross-pollinated crop. It is grown for its white tender curd and contains substantial amount of protein, carbohydrates, phosphorus, calcium, iron and ascorbic acid. Cauliflower thrives best in cool and moist climate and it does not withstand very low temperature or too much heat (Din *et al.*, 2007). It thrives best in a cool moist climate and it does not withstand very low temperature or too much heat (Din *et al.*, 2007). Seed is the basis of agricultural production and a key component among all inputs for sustainable crop production. It is estimated that quality of seed accounts for 20-25% of productivity (Anonymous, 2013) [7] for sustainable crop production, good quality seed is very important.

Gill and Singh (1973) [1] studied the effect of environmental factors on seed production of late Cauliflower in Kullu valley between 1958 and 1965 and noticed a great variation in the quantity of seed produced (0 to 291.25kg/ha). High mean maximum (16.43°C to 18.93°C) and minimum temperatures (4.67°C to 6.83°C) during October, November and December induced good vegetative growth. Fluctuation in temperature in February when curds are formed did great damage and reduced the seed yield by 49.17 to 100 per cent. So, climatically suitable location is needed for quality seed production of cauliflower. Keeping this in view, the present study was conducted to find out the viable seed and good quality seed present in the different locations.

## Material and Methods

Present investigation was carried out in the Laboratory of seed science and technology, Dr YSP UHF, Nauni, Solan to calculate various seed quality parameters different methods were incorporated. Seeds from three locations (Nauni, Saproon and Kandaghat) were collected and further investigation was carried out in the laboratory.

### Seed quality

Quality of cauliflower seed was determined by using tetrazolium test as per procedure given by Moore, (1995) [3]. The chemical used for the test was light yellow coloured water soluble powder and chemically called as 2,3,5-triphenyl tetrazolium chloride. For determining seed quality 1.0% solution of tetrazolium chloride was used. To prepare a 1.0% solution, 1 gram of tetrazolium salt was dissolved in 100 ml of distilled water. The pH of the solution was near to 7.0. 100 seeds from each location were stained in Petridishie/ Petriplate (9cm in diameter) containing the solution. The solution was sufficient to cover the seeds and allow its absorption. After a period of half an hour seeds from the tetrazolium solution were removed, rinsed 2-3 times in water and then evaluated.

### Electrical conductivity

Seeds are soaked in distilled water and electrical conductance of such water is tested. The increase in conductance is roughly proportional to the percentage of dead tissue. The increase in conductivity is due to leaching of metabolites from dead seeds.

### Speed of germination

Seed germination of each location was tested as per ISTA procedure (Anonymous, 1985) in the laboratory through towel paper method. Four hundred seeds of each location were placed in four replications (100 seeds each) in moist towel paper for germination. Number of seedlings emerging daily were counted from the day of keeping the seeds in the towel paper till the germination is complete. Seeds were allowed to germinate on the top of germination paper and final count was taken on 10<sup>th</sup> day. Germination percentage of each replication was worked out by using following formula;  
Seed vigour index I and II

$$\text{Germination (\%)} = \frac{\text{Number of seeds germinated}}{\text{Total number of seeds kept for germination}} \times 100$$

Seed vigour index of seeds collected from three study locations was calculated as per procedure given by Abdul-Baki and Anderson (1973) [2]. The rolled towel paper method was followed for the study. One hundred cauliflower seeds were kept per replication in between rolled moist towel paper for germination. Four replications were maintained per location. The seeds were kept in the centre of the moist towel papers in such a way that the micropyles were oriented towards bottom to avoid root twisting. The rolled towel papers with seeds were kept in the germinator maintained at a temperature of 24<sup>o</sup>C and 65 per cent relative humidity. After a specified period of time (10 days) towel papers were removed and five seedlings were selected and their dry weight (mg) and length (cm) of were recorded. Seed vigour indices I and II were calculated as follows;

$$\text{Seed vigour index I} = \text{Germination final count} \times \text{seedling dry weight (mg)}$$

$$\text{Seed vigour index II} = \text{Germination final count} \times \text{seedling length (cm)}$$

## Result and Discussion

In the present investigation “Effect of variable weather parameters on seed quality of cauliflower (*Brassica oleracea* var *botrytis* L.) in three locations of Solan district of Himachal Pradesh.

### Effect of weather conditions on seed germination of cauliflower

Statistically maximum mean seed germination was recorded in seed produced at Saproon (86.9%) followed by Kandaghat (83.2%) and minimum was recorded at Nauni (70.7%) (Table 1). There was no significant difference in seed germination between years. In interaction of year with locations, maximum seed germination was recorded at Saproon (89.5%) during 2014-15 and minimum was recorded at Nauni (70.2%) during 2014-15, which was also at par with seed germination at Nauni during 2015-16.

Similarly, highest root length was recorded at Saproon (5.64cm), followed by Kandaghat (5.44cm) and lowest at Nauni (3.94cm). Higher root length (5.23cm), was observed during 2015-16 than 2014-15. The interaction of location with year significantly maximum root length was recorded at Saproon (6.37cm) during 2015-16 and minimum was recorded at Nauni (3.54cm) during 2014-15.

The shoot length was also recorded maximum at Saproon (8.62cm), followed by Kandaghat (7.38cm) and minimum at Nauni (5.34cm). Higher shoot length (7.25cm) was recorded during 2015-16 than 2014-15. In interaction of location with year significantly maximum shoot length was recorded at Saproon (8.87cm) in 2014-15 which was also at par with shoot length at this location during 2015-16 and minimum at Nauni and during 2014-15 (5.04cm) and 2015-16 (5.63cm).

Maximum seedling fresh and dry weights, were also recorded at Saproon (0.334g, 0.054g, respectively.) and minimum at Nauni (0.266g, 0.040g, respectively). No significant differences in seedling fresh weight were found between years. In seedling dry weight locations, years and their interaction was also found non significant.

### Effect of locations with variable weather conditions on seed quality and seed vigour of cauliflower

Similar pattern was recorded in seed viability, with statistically highest seed viability was recorded at Saproon, (97.57%) followed by Kandaghat (96.28%) and lowest at Nauni (91.37%). No significant difference between years was observed.

Statistically highest electrical conductivity was recorded at Nauni (0.312), followed by Kandaghat (0.269) and lowest was recorded at Saproon (0.240). Higher electrical conductivity was recorded during 2015-16 (0.293) than 2014-15 (0.256). In interaction of locations and years highest Electrical conductivity (0.329) was recorded at Nauni during 2015-16 and lowest (0.231) at Saproon during 2014-15. Significant higher seed vigour index I and II was recorded at Saproon (560.81 and 2.63) followed by Kandaghat (531.8 and 2.21) and lowest was recorded at Nauni (436.01 and 1.87), respectively. Statistically higher seed vigour index I (511.5) was recorded during 2014-15 than 2015-16. In interaction of location with year, highest vigour index -I (655.89) was recorded at Kandaghat during 2014-15 and lowest (381.8) at Nauni in vigour index-II were recorded 2014-15.

No significant differences between years. In interaction of year with location, highest seed vigour index II was recorded at Saproon (2.71) during 2015-16 and lowest at Nauni (1.84) during 2014-15.

**Table 1:** Effect of weather conditions on seed germination of cauliflower

Location	Germination percentage (%)			Root length (cm)			Shoot length (cm)			Seedling fresh weight (g)			Seedling dry weight (g)		
	2014-15	2015-16	Mean	2014-15	2015-16	Mean	2014-15	2015-16	Mean	2014-15	2015-16	Mean	2014-15	2015-16	Mean
Nauni	70.2* (9.3)	71.2 (9.5)	70.7 (9.4)	3.54	4.35	3.94	5.04	5.63	5.34	0.290	0.243	0.266	0.041	0.039	0.040
Saproon	89.5 (10.4)	84.3 (10.1)	86.9 (10.3)	4.91	6.37	5.64	8.87	8.38	8.62	0.327	0.341	0.334	0.057	0.052	0.054
Kandaghat	84.3 (10.1)	82.1 (10.1)	83.2 (10.1)	4.60	4.98	5.44	6.97	7.80	7.38	0.317	0.301	0.309	0.052	0.049	0.051
Mean	81.33 (10.0)	79.22 (9.9)		4.35	5.23		6.92	7.25		0.311	0.313		0.053	0.046	
CD <sub>(p=0.05)</sub>	Location			(0.35)		0.12			0.98			0.04			NS
	Year			(NS)		0.14			0.11			NS			NS
	Location x Year			(0.90)		0.91			1.05			0.07			NS

\*The data in parentheses are  $\sqrt{N+1}$  transformed values.

**Table 2:** Effect of locations with variable weather conditions on seed quality and seed vigour of cauliflower

Locations	Viability of seed (%)			Electrical conductivity			Vigour index I			Vigour index II		
	2014-15	2015-16	Mean	2014-15	2015-16	Mean	2014-15	2015-16	Mean	2014-15	2015-16	Mean
Nauni	92.01 (10.5)	90.74 (10.3)	91.37 (10.6)	0.296	0.329	0.312	381.81	490.20	436.01	1.85	1.91	1.88
Saproon	98.35 (10.9)	96.80 (10.8)	97.57 (10.9)	0.231	0.250	0.240	497.19	624.43	560.81	2.57	2.705	2.64
Kandaghat	97.31 (10.8)	95.26 (10.7)	96.28 (10.8)	0.247	0.291	0.269	655.89	407.81	531.85	2.20	2.23	2.22
Mean	95.83 (10.8)	94.22 (10.7)		0.256	0.293		511.5	507.4		2.20	2.29	
CD <sub>(p=0.05)</sub>		(0.27)			0.41			11.39		0.59		
		(NS)			0.23			3.31		NS		
		(0.51)			0.65			22.11		0.68		

\*The data in parentheses are  $\sqrt{N+1}$  transformed values.

The seed germination and other seed quality parameters (vigour index I and II) of cauliflower seed were found greatest at Saproon, followed by Kandaghat and least values were recorded in seed produced at Nauni. These variations in seed quality may be attributed to variable weather conditions experienced by crop at respective locations.

The seed germination and quality parameters are also influenced by the size of curd on which seeds are produced. Kanwar *et al.* 2001, reported that maximum seedling length was recorded in seeds on medium curd size (5.79 cm) and minimum was observed at medium curd size (5.30 cm). Similarly maximum shoot length was found at *i.e.* 7.48 cm where as minimum shoot length was observed at very small curd size *i.e.* 6.87 cm.

Singh *et al.* (1959) <sup>[4]</sup> reported that maximum seedling fresh weight was recorded in seed produced from extra large curd size (0.324 g) while, minimum was recorded from very small curd size *i.e.* 0.299 g and on the other hand, seedling dry weight was found 0.056 g which is the minimum while small as well as extra large curd size have maximum seedling dry weight *i.e.* 0.062 g which is at par with all the treatments. Fresh and dry weight of seedling and germination along with seedling growth and dry weight are reflected in terms of vigour index I and II, respectively. Maximum seedling vigour index I as well as vigour index II was recorded in case of small curd size *i.e.* 575.38 and 2.77 respectively while, minimum vigour index I with vigour index II was observed at large as well as very small curd size respectively. Strydom (1998) also reported that in cauliflower, maximum seed viability was found at extra large curd size while, minimum seed viability was found in case of very small curd size.

### Conclusion

The minimum number of days for initiation of seed stalk (131.0), days to flower initiation (140.4days), 50 per cent flowering (150.6) and seed set (163.10) in cauliflower were observed at Nauni, followed by Kandaghat and Saproon. Number of pods per plant (1055.2 pods) and number of seeds per pod (18.4 seeds/pods) were found highest at Saproon as compared to other two locations. The maximum seed yield 239.6 kg/ha was also obtained at this location, followed by Kandaghat (236.7 kg/ha) and Nauni (174.0 kg/ha). The forenoon humidity during October to December exhibited significant and positive correlation with seed yield. During January to March, minimum temperature showed significant and positive correlation with seed yield. Whereas, during April to June, maximum temperature exhibited positive effect on seed yield.

### Seed viability

The seed viability was highest at Saproon (97.57%), followed by Kandaghat (96.28%) and least viable seeds were produced at Nauni (91.37%). The Maximum seed vigour index I and II were found in seeds harvested from Saproon, followed by Kandaghat and minimum was at Nauni location.

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