

## Determination of Physiological Maturity for Higher Seed Quality in Chicory (*Cichorium intybus* L) cv. Kalpa

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Chicory (*Cichorium intybus* L.) is used in traditional Siddha and Ayurvedic systems of medicine and acknowledged for its medicinal properties in naturopathy. The roots are widely used for blending with coffee. Apart from nutritional and medicinal qualities, chicory leaves are rich in antioxidant properties [1, 2]. The major drawback in the cultivation of medicinal plant is the lack of standard cultivation package, physiological maturity and non - availability of good quality seeds. A precise determination of the physiological maturity stage, permits an accurate measure of the duration of the seed filling period ensuring seed quality [3]. Such determination is very important because early or delayed harvesting of seed results in poor quality. The research work on seed maturation and production in this crop is relatively meagre in India [4]. With this background a study was undertaken for standardizing the optimum harvesting stage for good quality seed production in chicory cv. Kalpa.

The experiment was conducted at Agricultural College and Research Institute, Madurai between December 2003 and April 2004. To document the optimum physiological maturity stage, the plants in the rows were observed daily for bud initiation. When 50 per cent of the plants in a population had reached bud initiation stage, the buds were tagged (approx. 400 buds) and seeds were collected at five days interval from 5<sup>th</sup> day up to 45<sup>th</sup> day. Observations were recorded on seed quality parameters from five heads at random and the mean value was calculated.

Capitulum colour (variation in colour changes), capitulum length (between the stalk and the distal end) and diameter in cm, capitulum fresh weight and dry weight (after drying under ambient conditions for five days and then at 80°C for 16 h) seed fresh weight and dry weight (after drying at 80°C for 16 h) and seed moisture content (%) (after drying in hot air oven at 105°C for 16 ± 1h) were recorded.

The germination test was conducted immediately after seed extraction. In each test four replicates of 100 seeds were placed over top of paper media moistened with water and kept in germination room maintained at 25 ± 1°C and 95 ± 1% RH. After 14 days, the number of normal seedlings were counted and expressed in percent germination [5]. Other seedling characters like root length, shoot length and dry matter production were recorded using normal seedlings. The data were statistically analyzed in a Completely Randomised Block Design [6]. Percentage values were transformed to arcsine values wherever necessary.

Morphological characters of capitulum studied at different growth stages revealed changes in colour, length and diameter (Table 1). Initially, the capitulum was dark green, turned to green on 20<sup>th</sup> day, became brown on 35<sup>th</sup> day and finally attained dark brown colour on 45<sup>th</sup> day, Capitulum length increased from 0.50 cm on 5<sup>th</sup> day to 1.80 cm on 35<sup>th</sup> day. The capitulum diameter increased and reached maximum on 35<sup>th</sup> day (2.20 cm) and decreased thereafter to 1.75 cm on 45<sup>th</sup> day (Table 1).

Table 1. Effect of physiological maturity stages on capitulum characters in chicory cv, Kalpa

Stages	Capitulum Colour	Capitulum length (cm)	Capitulum Diameter (cm)	Capitulum dry weight (g)
5 DAI*	Dark green	0.50	0.80	0.05
10 DAI	Dark green	1.20	1.30	0.09
15 DAI	Green	1.30	1.50	0.10
20 DAI	Green	1.60	1.70	0.12
25 DAI	Pale green	1.70	1.74	0.15
30 DAI	Light brown	1.80	2.00	0.18
35 DAI	Brown	1.80	2.20	0.21
40 DAI	Brown	1.60	1.80	0.17
45 DAI	Dark brown	1.50	1.75	0.18
SEd		0.07	0.08	0.001
CD (P=0.05)		0.14**	0.15**	0.002***

Table 2. Effect of developmental stages on seed quality characters in chicory cv. Kalpa

Stages/ Characters	Seed colour	100- Seed weight (g)	Seed Moisture (%)	Germination (%)	Root length (cm)	Shoot length (cm)	Dry matter production (g)
15 DAI	Greenish white	0.061	44.4	-	-	-	-
20 DAI	White	0.092	47.0	-	-	-	-
25 DAI	Pinkish white	0.101	36.8	34.0 (36.77)	6.20	7.20	0.014
30 DAI	Straw brown	0.142	22.5	56.0 (43.80)	7.30	7.80	0.018
35 DAI	Brown	0.157	13.7	89.0 (57.14)	8.20	9.00	0.026
40 DAI	Dark brown	0.152	12.3	86.0 (55.72)	7.80	8.60	0.024
45 DAI	Dark brown	0.150	11.8	80.0 (53.41)	7.50	8.10	0.023
SEd		0.001	2.53	3.83	0.12	0.13	0.001
CD (P=0.05)		0.002**	5.51**	8.83**	0.28**	0.16**	0.002**

\*DAI - Days after initiation

\*\*Significant at 1% level

Figures in parentheses are arc sine transformations

Capitulum weight was the highest on 35<sup>th</sup> day (0.27 g) and declined on 45<sup>th</sup> day (0.24 g). This may be due to the shrinkage of capitulum as result of loss of moisture from it. Dry weight of capitulum (Table 1) also showed similar trend (0.21 g on 35<sup>th</sup> day and 0.18 g on 45<sup>th</sup> day).

The seeds were greenish white after 15 days, turned to white on 20<sup>th</sup> day and became brown after attaining full maturity on 35<sup>th</sup> day (Table 2). A steady increase in seed weight was observed, up to 35 days and the rate of increase was very marginal thereafter. The highest seed moisture content was

recorded on 20<sup>th</sup> day and it decreased gradually to 11.8 per cent on 45<sup>th</sup> day. The germination was 34 per cent in seeds extracted from 25 days old capitulum and attained maximum on 35<sup>th</sup> day (89 %). The root, shoot length and dry matter of seedlings exhibited similar trend (Table 2). A holistic view of all observations, indicated that the seed quality in terms of dry weight and germination reached a maximum on 35<sup>th</sup> day after floral initiation. At this stage, the moisture content was also minimum. These findings are in agreement with the reports in sunflower [7], marigold [8] and amaranthus [9].

The results of the present investigation revealed that the seeds of chicory attain physiological maturity on 35<sup>th</sup> day after initiation of flowering as observed by higher seed weight, germination and seedling dry weight. The capitulum and seeds attain brown colour at this stage.

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