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Effect of cycocel (CCC) on seed quality of soybean (*Glycine max* L. Merrill) cv. MAUS-162

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Abstract
As the title indicates the current work aims to identify the inhibitory effect of plant growth retardent on the growth conditions of soybean. The work revealed that, seed yield and yield components were significantly increased by CCC 500 ppm over other treatments and control. The application of chlormequat chloride had also resulted in higher seed yield, compared to control. The study revealed the superiority of CCC (500 ppm) treatment for majority of the morphological, physiological, growth, biochemical, quality and yield parameters at different growth stages, in addition to seed yield, compared to other treatments and control treatments. Suggesting the use of CCC will have many positive benefits on yield and yield attributing characters in cv. MAUS-162 of-soybean.

Keywords: Soybean, growth retardants, *Glycine max* L. Merrill, chlormequat chloride, mepiquat chloride, cycocel

Introduction
Soybean (*Glycine max* L. Merill) has been called miracle crop of the twentieth century. It is a highly nutritive and energy rich legume with 43 percent of biologically effective protein and 20 per cent of edible oil, besides the presence of good amount of vitamins, minerals, salts and essential amino acids. It serves both as pulse and oil seed crop and gives 2-3 times more protein yield than other pulses and can bridge the increasing gap between demand and supply for edible oils and pulses in the country. Being a legume, it also fixes atmospheric nitrogen and adds about 65-100 kg N ha^{-1} $year^{-1}$ to the soil which helps in increase of yields of the subsequent non-legume crop. Growth regulators are known to improve the source-sink relationship, translocation of photo-assimilates and thereby photosynthetic ability of the plants and thus play a significant role in realization of high productivity levels and higher crop yields. The use of plant growth retardants has therefore been described as the most important tool of the agriculturist to increase crop yields. Among the growth retardants, cycocel (Chlormequat chloride) reduce the inter nodal length, reduce plant height, influence source-sink relationship and stimulate the translocation of photosynthates towards sink. Foliar application of Chlormequat chloride was also reported to help in realization of higher assimilatory rates resulting in higher dry matter production. Cycocel also shorten and strengthen stems of the plants. The application of CCC was also reported to increases chlorophyll, oil and protein synthesis. Though, the plant growth retardants have great potential, their application and accurate assessment, etc., have to be judiciously planned in terms of optimal concentrations, stage of application, species specificity and the correct season. In view of their wide spectrum of effectiveness on every aspect of plant growth. The study of growth retarding compounds in pulses, particularly, soybean is scanty. Hence, the present investigation was undertaken to study the efficacy of chlormequat chloride on the growth, development and yield of the crop.

Material and Methods
The present investigation entitled "Effect of cycocel on seed quality of Soybean (*Glycine max* L. Merrill) cv. MAUS-162" was undertaken during 2013-14 season at the College Farm, College of Agriculture, VNMKV, Parbhani. The material and methods followed in the experiment are furnished hereunder.
The field trial was conducted following randomized block design with seven treatments replicated thrice. Each plot measured 2.70 x 5 m. A spacing of 45 x 5 cm was maintained between and within the rows. Between the replications, one meter space was left for irrigation.
The present investigation consists of soybean *cv* MAUS-162 and one growth retardant CCC (chlormequat chloride).

The growth retardent were sprayed at flower initiation stage. The experiment was conducted with the chemical involving seven treatments .The details of the treatments are furnished below. All the plants from one meter square were harvested at maturity to record data on the following yield attributes, namely, number of pods per plant, number of seeds per pod and 100-seed weight. After threshing, cleaning and drying, seed yield, biological yield and harvest index from each treatment and replication was recorded and the data was used to express the seed yield on hectare basis.

Treatments

T_{1}- Control
T_{2}- 400 ppm
T_{3}- 450 ppm
T_{4}- 500 ppm
T_{5}- 550 ppm
T_{6}- 600 ppm
T_{7}- 650 ppm

Results and Discussion

Yield is the manifestation of physiological processes occurring in plants over time and is related to the production of dry matter and its proper partitioning. In general, crop yield depends not only on the accumulation of photo assimilates during the crop growth and development, but also on its partitioning in the desired storage organs of plant. The growth retardants are capable of redistribution of dry matter in the plant and there by bringing about an improvement in the yield potential.

Table 1: Effect of CCC (plant growth retardant) on yield and yield attributes in soybean cv.MAUS-162.

Treatments	No. of pods/ plant	No. of grains/ pod	100 seed wt. (g)	Grain yield (q/ha)	Biological yield (q/ha)	Harvest index (%)
T_{1} (control)	24.00	2.40	10.56	18.41	45.75	40.24
T_{2} (400 ppm)	28.66	2.69	12.24	21.38	47.76	44.77
T_{3} (450 ppm)	32.99	2.64	12.20	23.81	49.26	48.34
T_{4} (500 ppm)	37.49	2.84	13.32	24.72	51.05	48.42
T_{5} (550 ppm)	34.50	2.51	11.30	22.50	47.08	47.79
T_{6} (600 ppm)	31.36	2.70	12.50	22.30	45.56	48.95
T_{7} (650 ppm)	29.66	2.42	10.88	20.01	44.69	44.78
SE ±	1.00	0.084	0.38	1.20	0.92	1.09
CD at 5%	3.10	0.26	1.17	3.71	2.84	3.37

Table 2: Effect of CCC (plant growth retardant) on Germination %, Vigour index, Protein content and Oil content in soybean cv.MAUS-162

Treatments	Germination %	Vigour index	Protein content %	Oil content %
T_{1} (control)	76.25	1988	34.54	18.06
T_{2} (400 ppm)	81.00	2173	35.93	20.25
T_{3} (450 ppm)	79.18	2178	35.37	19.45
T_{4} (500 ppm)	87.98	2475	42.75	20.58
T_{5} (550 ppm)	80.12	2355	37.50	20.17
T_{6} (600 ppm)	84.37	2515	36.56	20.51
T_{7} (650 ppm)	78.12	2146	34.86	18.75
SE ±	2.15	10.90	0.29	0.25
CD at 5%	6.61	33.61	0.96	0.77

In the present study (results are presented in Table. 1 and 2), The results revealed the existence of significant differences among the treatments studied in the present investigation. Among the treatments, application of CCC (500 ppm) had recorded significantly higher seed yield (24.72 q/ha), compared to other treatments studied.

The yield components, *viz.*, number of pods per plant, number of seeds per pod, 100 seed weight, seed yield were strongly influenced by the application of different concentrations of growth retardant, indicating the importance of these concentrations in increasing the yield potential through their effect on various morphological, physiological, biochemical and yield component traits. The application of different concentrations of growth retardent was observed to result in significant increased in the number of pods per plant, number of seeds per pod, biological yield, the seed yield and hence Harvest index. The application of CCC (500 ppm) had resulted in significantly higher seed yield (24.72 Q ha^{-1}) followed by CCC (450 ppm), (23.81 q/ha^{-1}) compared to control (18.41 q ha^{-1}). The germination percentage also increased by the application of CCC. Mostly the treatment of 500 ppm shows, maximum *i.e* (87.98%). Vigour index was increased with the treatment T_{6} *i.e.*600 ppm. Protein content also increased with CCC 500 ppm (42.75%) and Oil content also increased with the treatment of CCC 500 ppm (20.58%) All these parameters are having a significant and positive correlation with good seed yield and better quality. Several research workers had also reported similar increase in yield components and yield with the application of chlormequat chloride.

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