EFFECTS OF COPPER SULPHATE ON SEED GERMINATION AND GROWTH OF SOYABEAN CROP

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Abstract

Copper Sulphate treatment produced toxic effects on seed germination and seedling growth of Soyabean crop along with significant reduction in seedling dry weight as compared to control treatment. Similarly, the tolerance to copper treatment decreased the tolerance indices for water Soyabean seedlings with the increase in metal concentration in the substrate as compared to control. The difference in tolerance and seedling vigour index in response to copper sulphate toxicity should be considered while Soyabean cultivated in copper contaminated areas. Seeds treated with distilled water were recorded highest seed germination percentages and also root, shoot, seedling length and dry weight of seedling, followed by seeds treated with copper sulphate, decreases the overall growth parameter of seedling.

Keywords: soyabean, copper sulphate, Seed germination and dry weight etc

Introduction

Soyabean is a major Kharif crop of the Country. Maharashtra leads the production and there are reports of area covered between 40 to 42 lakh hectares. Soyabean is the second-largest crop in the state after cotton and gives good returns to the farmers almost every year. The crop had given decent returns in the previous season as well. As per state Agriculture Ministry more than 1000 farmers have file complaints, regarding non-germination of the soybean seeds. Maharashtra Agriculture Minister Mr. Dada Saheb Bhuse told media persons that legal actions will be taken against all those, including the state agencies, if it is proved after investigation, that there was supply of inferior quality seeds to the farmers. Timely onset of the monsoons was encouraging for the farmers go for early sowing, especially in Marathwada and Vidarbha. The oilseed is sown in June and harvested in October with the oil marketing year lasting till next September.

Soil salinization is one of the major factors of soil degradation. Salinity inhibition of plant growth is the results of osmotic and ionic effects and the different plant species have developed different mechanisms to cope with these effects. Reduction in osmotic potential in salt stressed plant can be a result of inorganic ion (Na^+, Cl^- and K^+) and complete organic solute (soluble carbohydrates, amino acids, proline, betaines, etc.). Shen *et al.,* (1998) [22] has studied the effect of copper (Cu) and zinc (Zn) toxicity on growth of mung bean (*Phaseolus aures* Roxb. cv VC-3762) in a solution culture. The mechanisms involved in heavy metal tolerance may range from exclusion, inclusion and accumulation of heavy metals depending on the plant species (Munzuroglu and Geckil, 2002; Kaushik *et al*., 2005; El-Tayeb *et al*., 2006) [18, 14, 10, 11]. There was a progressive decline in germination percentage and seeding growth with increasing copper sulphate concentration. Field studies were conducted in the same manner. The

soyabean crop was raised in the experimental plots of lm x lm size. The experimental results showed that better growth of the crop occured at control. There was decreasing trend in all growth parameters with increase in copper sulphate concentration. Farmers of Maharashtra are facing problem of early germination failure at present. Although sowing commenced early in the state this year but due to poor or inferior seed quality, the farmers in a dilemma regarding fate of the crop grown in their fields. In few cases, seeds are unable to germinate owing to insufficient moisture available in the soil.

According to Bernstein and Hayward (1958) [5] and Strognov (1946), deleterious effects of saline conditions on plant growth are attributed to two main factors namely, increase in osmotic pressure of rooting medium and specific ion effects.

Magistad *et al.,* (1943) [16], Magistad *et al.,* (1945) [17], Hasson *et al.,* (1960) and Kumar (1973) explain the extent of injury to plants by salinization of the medium varies with the type of predominant ions, their concentration, the physiological stage of plant growth at which it is exposed to salinity and plant species.

Effect of salinity on plant growth is reflected in stunted growth of plant. Yields of plant like *solanum lycopersicum* is reduced, partly not only due to fewer fruits per plant but also due to marked decrease in fruit size.

Among the vegetables, some plants can tolerate only 2 millimhos/cm of salinity level while other can tolerate as high as 8 millimhos/cm salinity level. 126 Climate influences profoundly the salt tolerance of certain plants. *Alium cepa* is much more severely affected in hot dry areas than the cooler humid area.

Material and Methods

The seeds were either collected from the cultivated plants or procured from local market.

They were stored in dry and stoppered glass bottles in dark. Studies on seed germination were conducted in sterilized petri dishes lined with a single layer of whatman no.1 filter paper kept moist with distilled water or test solution.

They were imbibed in distilled water or test solution (10ml) in dark for 6 to 8 hours. The studies involved use of 200 seeds of soyabean in different concentration along with distilled water as control for 6 h.

The seeds were then transferred to with cocopeat containing germination tray respective solution of copper sulphate concentration and distilled water. The germination tray was incubated at green shed net (polyhouse) condition still germination and Then percent germination was calculated on the basis of seed germination and also seedling height, root length, and the biomass of seedling were measured. Germination percentage was recorded on the 10th day. Germination was considered to have occurred when radicals attained a length of 2 mm. Germination percentage was calculated according to ISTA (1999) [12].

$$\text{Seed Germination \%} = \frac{\text{Total Number of seeds germinates in particular treatment}}{\text{Total Number of seeds treated in particular treatment}} \times 100$$

The dry biomass was determined by placing the seedling in an oven at 80 °C for 24 hours.

Preparation of Solution

Table 1: Different concentration of Copper Sulphate

Name of Salt	Concentration (ppm)
Copper Sulphate	30
	60
	90
	120
	Control Distilled water

Results

Table 1: Effects of different concentration of Copper Sulphate on seed germination (%), seedling growth and seedling dry weight (g) of Soyabean

Cu So_4 concentration in ppm	Germination (%)	Root length (cm)	Shoot length (cm)	Seedling size (cm)	Seedling dry weight mg/g
30	84	4.9	5.2	11.2	1.2
60	61	3.4	4.3	10.1	0.62
90	49	2.7	3.1	6.5	0.32
120	30	2.1	2.1	5.2	0.12
Control (D/W)	95	9.7	14.2	19.2	3.1

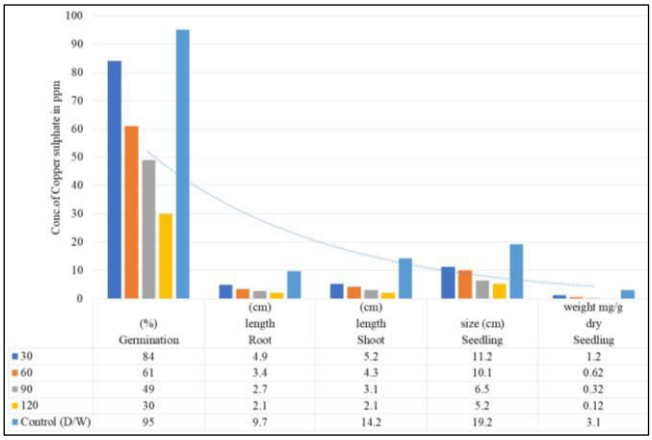

Fig 1: Soyabean plant parameter

The Results showed that seeds treated with distilled water were recorded highest seed germination percentages and also root, shoot, seedling length and dry weight of seedling, followed by seeds treated with Copper sulphate decreases the overall growth parameter of seedling mentioned in Table.1

Discussion

In present investigation on the effect of Potassium Sulphate on germination, growth parameter of Soyabean seedling found that the Excessive concentration of Copper sulphate generally produce common toxic effects on different growth variable of plants, such as low biomas accumulation, chlorosis, inhibition of growth and photosynthesis, altered water balance and nutrient

assimilation, and senescence, which ultimately cause plant death. The plant under abiotic stress conditions are most likely to be adversely affected by heavy metals contamination.

The Results showed that seeds treated with distilled water were recorded highest seed germination percentages and also root, shoot, seedling length and dry weight of seedling, followed by seeds treated with Copper sulphate decreases the overall growth parameter of seedling mentioned in Table-1. Same work was carried out by Jay *et al*. (2011) [13] on mung bean cultivar and Dharam *et al*. (2007) [9] on wheat who reported a reduction of plumule and radicle length with increase in copper sulphate concentration. The reduction in the shoot length could be due to excess accumulation of copper salt in the cell wall, which modifies the metabolic activities and limits the cell wall elasticity (Naseer, 2001)
[19].

Conclusion

In present studies was concluded that the Copper sulphate treatment produced toxic effects on seed germination and seedling growth of Soyabean along with significant reduction in seedling dry weight as compared to control treatment. Similarly, the tolerance to copper treatment decreased the tolerance indices for water Soyabean seedlings with the increase in metal concentration in the substrate as compared to control. The difference in tolerance and seedling vigour index in response to Copper sulphate toxicity should be considered while Soyabean cultivated in copper contaminated areas. There is a need to be carried out further studies on other Copper sulphate tolerant species for plantation in Copper sulphate contaminated areas to overcome the shortage of agriculture crops.

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