

IMPACT ON GERMINATION AND SEEDLING DEVELOPMENT IN CHILLI (*CAPSICUM ANNUM* L.) BY APPLICATION OF ORGANIC AND INORGANIC TREATMENTS

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ABSTRACT

The application of organic and inorganic treatment to the soil is considered as a good agricultural practice because it improves the fertility of the soil and plant quality in chilli varieties CO-1, K2 and Jwala based on Germination percentage, Root length, Shoot length and Vigour index. The organic treatments were panchakavya 3%, vermicompost 3% and its Consortia. And the inorganic treatment was Sodium azide 0.02% used for this experiment. The experimental seedlings of the panchakavya crops of CO-1 variety recorded higher rates of germination percentage, root length and shoot length over the control and other treatments.

Keywords : Chilli, Panchakavya, organic, inorganic treatments and Vermicompost.

INTRODUCTION

Chilli (*Capsicum annum* L.) is belonging to the family Solanaceae was considered as a part of a common spice and folk medicine in human lives across many parts of the world. Capsaicin is the active compound in chillies, which gives pungency[1]. The capsicum fruits were used as a counter-irritant in neuralgia and in rheumatic disorders. Pungency varies with different varieties of chillies. The capsaicin content in chilli extracts or oleoresins (crude extract of Capsicum fruits) can be determined colourimetrically[2] The various contents of chili are nitrogenous compounds like capsaicin (0.14%) [3] dihydrocapsaicin, nordihydrocapsaicin, homodihydrocapsaicin, terpenoid compounds like steroidal glycosides, other compounds like carotenoid like carotenoid pigments, fat, protein, vitamin C, vitamin A, volatile oils, scopoletin.

Inorganic treatments panchakavya has the vital potential to play the role of growth promoting and immunity providing to the plant system[4]. The vermicompost has the capacity to supply nutrients and to support for the beneficial microbes which is used widely in agricultural fields and horticultural crops. vermicompost has all the characteristics which can be used as organic manure. Application of organic manure in generally enhances the availability of micronutrients like zinc, iron, manganese and copper.

In many situations, a combination of organic and inorganic fertilizers have produced higher yields than alone [5]. Chemical treatments have become an important tool in crop improvement in various susceptible crops to improve the yield and quality traits against harmful pathogens[6] it is a method to create genetic variation resulting in new varieties with better characteristics[7,8]. Sodium azide creates point mutations and damages the chromosomes and thus produces tolerance in the plants for numerous adverse conditions[9].

MATERIALS AND METHODS

The present germination study was carried out at the field, Department of Plant Biology and Plant Biotechnology in Quaid e Millath Government college for women. The seed varieties CO-1 and K2 were collected from the TNAU, Coimbatore and Jwala variety were collected from the horticultural department Srivilliputtur.

1.GERMINATION EXPERIMENT

The experiment was conducted in the seed germination trays of 30 x 20 cm size. 25 seeds of each chilli varieties were sowed in four replicates by the organic treatments are panchakavya3%, Vermicompost3% and its combined effect and Chemical treatment Sodium azide 0.02%. The seeds were soaked for 3hrs in each treatment before sowing in trays. The seeds soaked in distilled water were considered as control. Seeds are allowed to germinate for 15days to measure the germination qualities. Seeds were considered germinated when the radicle was twice the length of the seed. To obtain accurate results it is necessary to be in time for this evaluation in the fields as was planned in days.

- ❖ Germination percentage(%) is calculated by Number of seeds germinated by a total number of seeds sowed
- ❖ Seed germination and vigour index

For determination of seedling vigour index 5 seedlings were randomly selected from each tray and their individual shoot and root length were measured. The vigour of the seedlings was determined by following the formula of [10]. Vigour index = [length of the root (cm) + length of the shoot (cm)] x Percentage of seed germination.

DATA ANALYSIS

The data were analyzed using two way ANOVA in SPSS version 21 software.

RESULT AND DISCUSSION

In Fig.1 The results of the germination percentage of chilli genotypes as influenced by organic treatments like Panchakavya, Vermicompost, Consortia and chemical treatment like Sodium azide which reveals significant differences in all the treatments. Out of all the treatments and varieties of chilli the mean values of germination, seedling length, vigour index(table 1).The germination percentage of chilli CO-1 variety in Panchakavya treatment shows the highest germination percentage was highly influenced by 3% Panchakavya treatment. The mean of germination was observed in the CO-1 variety 95.5% followed by 3% Vermicompost in CO-1 variety 93.25% found similar to D.Balasankar et al[11]., revealed that K1 variety showed increased germination percentage in chilli.

Zheng et al 2007[12] demonstrated that nano- tio2 helped the water absorption by the spinach seeds, and germination of seeds was accelerated and highest percentage of the seed germination was found at the concentration of 7.5% of nanoparticles in 48hours. Muhammad Arshad Javed[13] showed the results of maximum germination percentage was achieved at 96% which is similar to our results. Higher seed germination give rise to healthy seedlings which later contribute to an increase in yield of production by (Hojjat, S.S.2011)[14].

In Fig.2 among the different treatments, the result showed the increased length of root 3.6% in CO-1 variety in panchakavya treatment compared to the K2 variety showing 1.9% in sodium azide treatment. In Fig.3 the result of the shoot length as influenced by panchakavya treatment shows an increased length of 6.4cm in CO-1 variety followed by 6.2cm in Jwala variety of same panchakavya treatment. Samira et al., (2013)[15] and Zhani et al., (2015)[16] obtained similar results for increased root length in CO-1 chilli variety. Root length and shoot length are the important characters to be given consideration under any conditions and have an ability to withstand under drought by Leishman and Westoby, 1994)[17].

TABLE 1. Effect of seed treatments in chilli (*Capsicum annum*) varieties

Varieties	Parameters	Germination percentage	Root Length (cm)	Shoot Length (cm)	vigour Index
	Treatments				
CO-1	T0	83.25	2.9	5.12	667.87
	T1	95.5*	3.62*	6.45*	962.05*
	T2	93.25	3.4	6.17	892.82
	T3	84.5	2.85	5.3	690.97
	T4	64.25	2.1	4.32	451.1
K2	T0	75.75	2.75	4.975	596.62
	T1	86*	3.22*	5.85*	780.42*
	T2	78	2.87	5.77	674.42
	T3	74	2.55	4.8	548.47
	T4	56.00	1.92	3.8	320.15
JWALA	T0	74	2.7	5.12	579.12
	T1	80.25*	3.2*	6.22*	724.1*
	T2	74.5	3.17	5.87	702.3
	T3	75.5	2.7	5.17	594.12
	T4	61.25	2.02	3.85	359.52
	Mean	78.57	2.79	5.25	636.27
	SD	9.60	0.49	0.82	176.34
	SE	2.47	0.12	0.21	45.53

*Significant at 5% level

Table 2 Tests of Between-Subjects Effects

Dependent Variable: GERMINATION

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6695.233 ^a	14	478.231	61.399	.000
VARIETY	1512.433	2	756.217	97.089	.000
TREATMENT	4677.733	4	1169.433	150.141	.000
VARIETY * TREATMENT	505.067	8	63.133	8.106	.000
Error	350.500	45	7.789		
Total	363402.000	60			
Corrected Total	7045.733	59			

a. R Squared = .950 (Adjusted R Squared = .935)

Table 3 Tests of Between-Subjects Effects

Dependent Variable: ROOT LENGTH

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	13.925 ^a	14	.995	31.632	.000
Intercept	470.400	1	470.400	14959.717	.000
VARIETY	1.009	2	.505	16.044	.000
TREATMENT	12.587	4	3.147	100.071	.000
VARIETY * TREATMENT	.329	8	.041	1.309	.263
Error	1.415	45	.031		
Total	485.740	60			
Corrected Total	15.340	59			

a. R Squared = .908 (Adjusted R Squared = .879)

Table 4 Tests of Between-Subjects Effects

Dependent Variable: SHOOT LENGTH

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	38.031 ^a	14	2.717	77.491	.000
Intercept	1656.901	1	1656.901	47265.019	.000
VARIETY	1.893	2	.947	27.000	.000
TREATMENT	35.676	4	8.919	254.425	.000
VARIETY * TREATMENT	.462	8	.058	1.647	.138
Error	1.578	45	.035		
Total	1696.510	60			
Corrected Total	39.609	59			

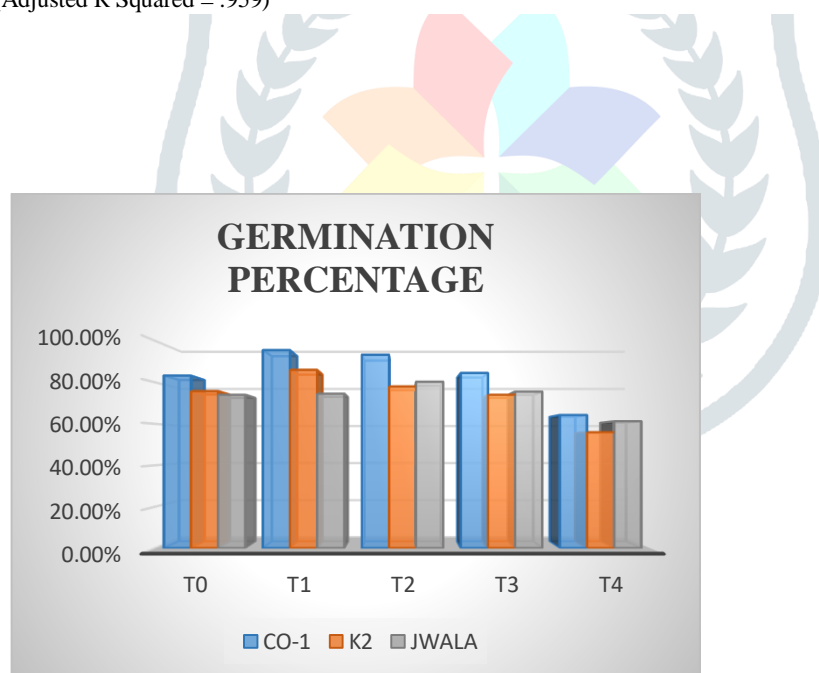
a. R Squared = .960 (Adjusted R Squared = .948)

Table 5 Tests of Between-Subjects Effects

Dependent Variable: VIGOUR INDEX

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1742956.742 ^a	14	124496.910	100.451	.000
Intercept	24300806.723	1	24300806.723	19607.202	.000
VARIETY	280380.214	2	140190.107	113.113	.000
TREATMENT	1400502.004	4	350125.501	282.500	.000
VARIETY * TREATMENT	62074.524	8	7759.315	6.261	.000
Error	55772.175	45	1239.382		
Total	26099535.640	60			
Corrected Total	1798728.917	59			

a. R Squared = .969 (Adjusted R Squared = .959)

**Fig.1** Effects of different treatments on seed germination percentage of chilli varieties

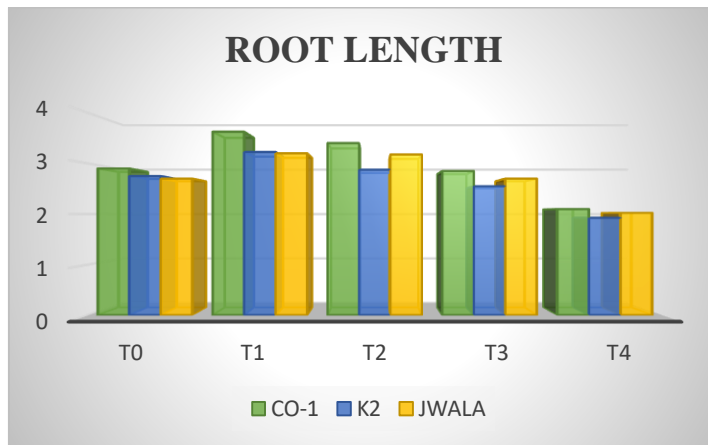


Fig.2 Effects of different treatments on root length of chilli varieties.

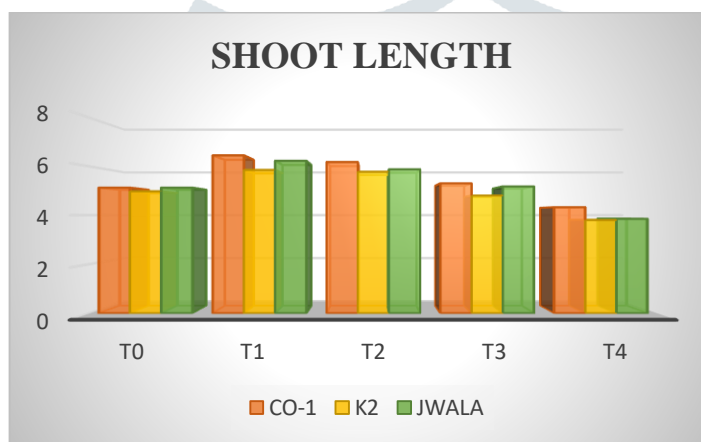


Fig.3 Effects of different treatments on shoot length of chilli varieties.

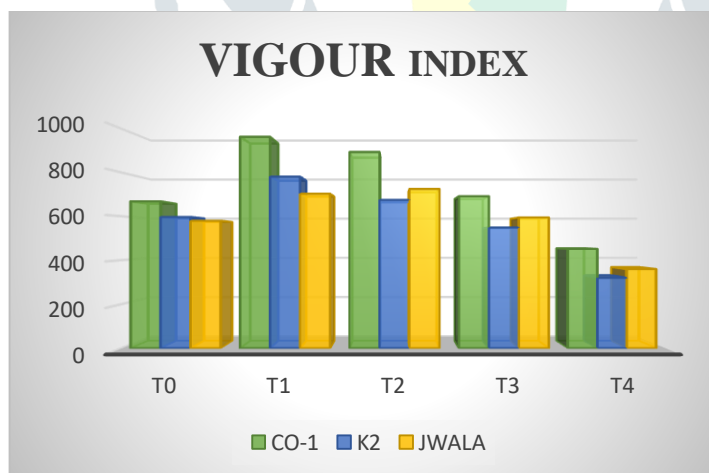


Fig.4 Effects of different treatments on vigour index of chilli varieties

In Fig 4. Vigour index is the product of germination percentage and seedling growth showed In the graph. The analysis of the vigour index revealed that the CO-1 variety of exhibited highest vigour index of 962.05 in panchakavya treatment followed by 892.28 in vermicompost treatment of same CO-1 variety. This same result also coincides with the results of D.Balasankar et al., 2017[11] which shows the highest mean value of 218.30 in (100mM of NaCl) treated CO-1 variety. This result is also similar to the M.Ahsanur Rahaman et al., 2010[18] recorded the highest vigour index 868.65% in bio compost (3kg/pot) + NPK treatment. From the above findings, it may be concluded that organic treatment can increase seed germination % and vigour index of chilli.

CONCLUSION

From the above findings, it can be concluded that the panchakavya treatment of all varieties showed considerable improvement in all parameters. CO-1 variety has responded better for all the treatment than other varieties like K2 and Jwala. So panchakavya can play a vital role in the depletion of inorganic treatments or increasing the soil nutrients and fertility, this integrated approach can contribute to improving crop production.

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