



A STUDY ON THE EFFECT OF SOIL PARAMETER (NPK) ON SEED GERMINATION AND EARLY SEEDLING GROWTH OF *PENNISETUM TYPHOIDES* IN CONTAI BLOCK AREA, PURBA MEDINIPUR, WEST BENGAL

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ABSTRACT

*Pearl millet being C₄ species has very high photosynthetic efficiency and also has ability for dry matter production. In Indian sub-continent pearl millet important course grain cereal and forage crop of the arid and semi arid. Population is increasing day by day. To meet its growing demand high fodder yielding and nutritious varieties of fodder crops are needed. Pearl millet (*Pennisetum typhoides*) is an excellent choice for this purpose. The research was undertaken to determine the effect of soil parameter (NPK) on seed germination and early seedling growth of *Pennisetum typhoides* in Contai Block area ,Purba Medinipur,West Bengal, Coordinates: 21.78°N, 87.75°E. To study the effect of soil parameter (NPK) on seed germination and early seedling growth we used natural soil parameter. The different parameters are i) Plumule and radicle ratio, ii) Fresh wt. and dry wt of germinated seeds, iii) Height of the stem, iv) Fresh wt. and dry wt. of stem, v) Root length, vi) No. of leaves, vii) Internodal length etc.,. The pot culture experiment was 60 days and concentration show the result of the study. The experiments show that natural soil parameters can show the normal growth result for seed germination and early seedling growth.*

Key Words : *Pennisetum typhoides*, natural soil parameter, seed germination, early seedling growth.

Introduction

Chemical factors of the soil which play an important role in the productivity considered to be essential are pH, total nitrogen (N), available phosphorus, organic carbon, potassium (K) etc. The soil was taken from Chatradhara in Contai block area Purba Medinipur district, contains sandy loam type soil. The various parameters observed are pH (6.5), carbon percentage (.68), N₂ (479 Kg/ha) P₂O₅ (14.0 Kg/ha), K₂O (538 Kg/ha), Sulphur (14.81ppm), Zinc (1.17 ppm), Boron (.29ppm), Iron (8.15ppm), Mn (18.14ppm), Cu (2.67ppm). The various crops i.e. sunflower, maize, rice etc are cultivated in this soil. But the research was undertaken to determine the effect of soil parameter (NPK) on seed germination and early seedling growth of pearl millet, a highly nutritious C₄ plant. The objective of the study – using natural soil parameter to investigate the germination percentage of pearl millet seed along with radicle plumule length and also the fresh weight and dry weight of germinated seedlings, and early seedling growth of *Pennisetum typhoides* are of great emphasis.

Material methods

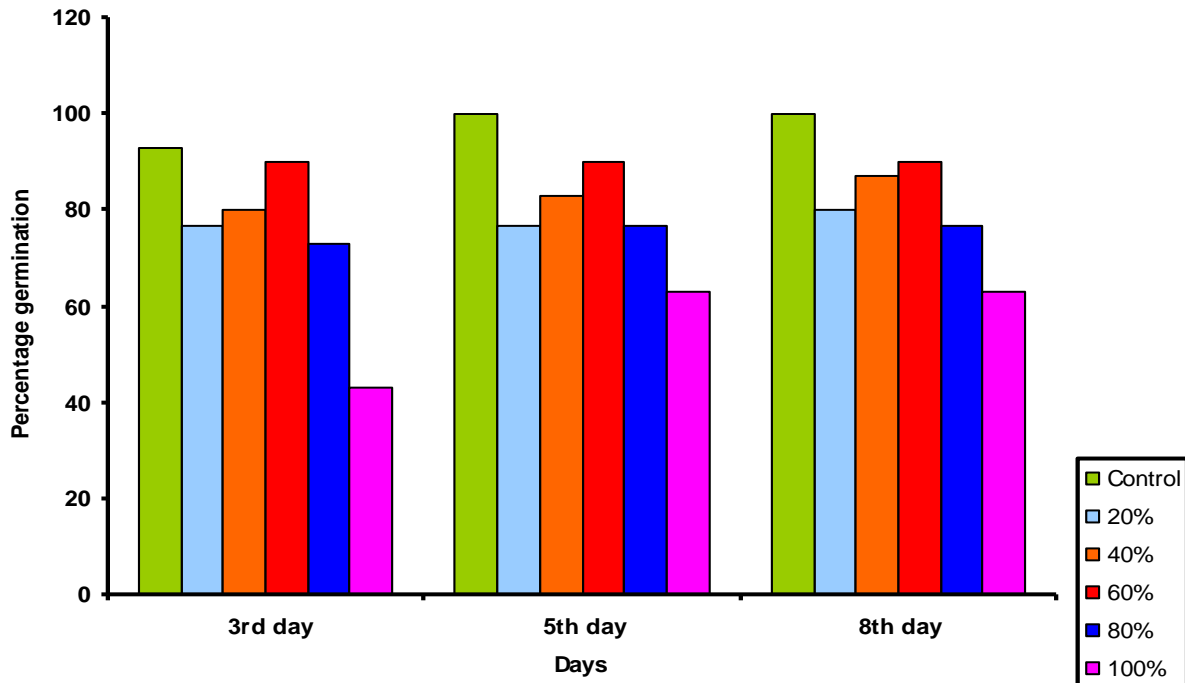
The sandy loam type soil was taken from Chatradhara of Contai block area. In all analysis air dried soil samples passing through 2.0 mm sieve were used. pH was determined in 1:2 soil water suspension with an Elico glass electrode pH meter. Electrical Conductivity was determined in the supernatant liquid of the sample with the help of solubridge. The available nitrogen was determined by Potassium permanganate solution and distillation method by Subbiah and Asija, 1956. Available phosphorus was determined by Olsen's method by Olsen et al, 1954. Available potassium was determined by neutral normal ammonium acetate in a given soil: solution ratio. The K content in the equilibrium solution was estimated with flame photometer. The seeds were collected from authorized service center Bera Beej Center, Ulbaria, Howrah, certified seeds of HHB-67 variety of *Pennisetum typhoides*. The seeds of pearl millet were taken and soaked in water for 6 hours. Then these were taken out and soaked in solution of 0.01% HgCl₂ for 2 minutes to avoid the fungal infection of seeds and then washed in distilled water. Total eighteen Petri plates (for six setups in the multiple of three) were used. At one time, ten seeds were taken on double folds of Whatmann No 1 filter paper for every Petri plate and supplied with different doses soil parameter controlled conditions at 25 (± 1⁰C) in Seed Germinator for the experimental time period (1-8 days). Out of total seeds incubated in each petri plate, the germinated seeds were counted and germination percentage was calculated. In each seed 3.0 mm of radicle

emergence was considered as germination. Length of plumule and radicle of these seedlings were measured using scale. Plumle/ Radicle ratio was calculated for each of the three replicates and their average were calculated from every experimental setup on 8th day. To calculate the fresh weight, after 8 days of germination seedlings were taken from each Petri plate irrigated with soil parameter (NPK) concentration from 20% to 100% and weight of seeds were recorded using electronic weighing balance. We used same method to determine the dry weight which were used in estimation of fresh weight, were taken and dried in a hot air oven for 48 hours at 70^oC. After drying, weight of these seedlings was recorded. For pot culture studies for this experiment, type of soil taken was sandy. The soil was collected from field of Contai Area, Purba Medinipur; from a depth of 0-15 cm. Then the soil was dried under Sun heat and well grinded. After that, it was properly sieved with 2.0 mm sieve. Total 18 earthen pot (9 for natural soil parameter NPK, and 9 for chemical fertilizer NPK 10:26:26) having capacity of around 4.0 kg soil were taken (for 6 setups in the multiple of three) having diameter almost of 25.0 cm. These pots were having a small hole underneath. Pots were numbered as 1, 2, 3, 4, 5, , 17, 18. In each pot, 2.0 kg of soil was filled after weighing. Seeds of pearl millet were soaked in water for 8 hours before sowing. Then in each pot 8 seeds were sown at the depth of 1.5– 2.0 cm. Then these pots were irrigated with different doses of concentrations i.e. Control, 20%, 40%, 60%, 80% and 100% regularly up to 60 days. As those days were very hot, so to check the loss of water evaporation these pots were covered with green leaves taken from *Dalbergia sisso* tree. This also helped in maintaining humidity and early germination of these seeds. After the 2 days of sowing, the seeds get germinated. After 6-7 days, the leaves covered on pots were removed. The pots were placed at such a place where they can get proper sun light and air. After 10 days of sowing, thinning was done. In the process of thinning all the plants except two were removed. The following observations of plants i.e. number of leaves, height of stem and collar diameters of stem were determined. The length of stem and leaves were measured with the help of meter scale and collar diameter was measured with the help of Vernier Caliper at 15th, 30th, 45th and 60th day. After this plants were cut from soil surface. Then all the leaves from the stem are removed and the internodal length was recorded from below to upward side. The remaining part of the plant i.e. root was extracted from the pot and their length were recorded. Then the fresh weight and dry weight of stem and roots were also recorded. Our objective of the study is to observe the effect of natural soil parameter on germination and early seedling growth in various stages of pearl millet.

Results and Discussion

Bar 1.

RESULTS OF SEED GERMINATION EXPERIMENT



$$\text{Percentage of germination} = (\text{No. of seeds germinated} / \text{total No. of seeds}) \times 100$$

The germination percentage of pearl millet decreased as the concentration of NPK increased. The maximum germination percentage i.e. 100% was observed under control and minimum i.e. 64.4 % was observed under 100% concentration of on 8th day of germination. The percentage of seed germination increased up to 60% concentration of NPK. The percentage of seed germination at 20 per cent concentration of soil parameter was found to be 80% and at 60% concentration it was found to be 90%.

TABLE 1.

Effect of soil parameter on the on the plumule length and radicle length (cm) of germinated seedling of pear millet after 8 days.

Concentration	Length of plumule(cm)	Length of radicle(cm)	Plumule radical ratio(cm)
Control	5.4	16.5	0.33
20%	5.5	15.5	0.33
40%	5.9	16.7	0.36
60%	6.6	18.6	0.35
80%	3.4	11.6	0.30
100%	1.4	4.8	0.29

Plumule radicle ratio was recorded maximum under soil parameter i.e. 0.36 at 40% & 60% conc. and minimum i.e. .29 at 100%.

Table 2. Effect of different concentration soil parameters (NPK) of the fresh weight and dry weight (gm) of germinated seedlings of pearl millet after days.

Concentration	Fresh weight of seedlings (cm)	Dry weight germinated seedlings (cm)
control	1.280	0.106
20%	1.316	0.115
40%	1.410	0.1289
60%	1.450	0.137
80%	0.952	0.086
100%	0.550	0.048

The fresh wt. and dry wt. of germinated seedling of pearl millet were observed to be minimum i.e. 0.550 gm and 0.048 gm respectively at 100% concentration; and to be maximum i.e. 1.450 gm and 0.139 gm respectively at 60 percent conc. soil parameter.

Table 3. RESULT OF POT CULTURE STUDY

The height of the stem (cm), under control (natural soil parameter) and chemical fertilizer NPK 10:26:26.

Concentration	Height of the stem							
	Soil parameter				Chemical fertilizer NPK 10:26:26			
	15 TH	30 TH	45 TH	60 TH	15 TH	30 TH	45 TH	60 TH
	DAY				DAY			
Control	3.5	5.8	9.9	29.6	4.6	6.9	12.1	41.2
20%	3.0	6.2	10.7	40.1	4.5	6.1	11.8	42.8
40%	3.6	6.6	11.9	43.8	4.5	6.3	12.7	45.4
60%	4	7.1	12.7	47.5	4.7	6.3	13.5	47.4
80%	4.3	8.7	13.1	52.1	5.1	6.9	13.9	59
100%	3.1	5.6	8.7	27.7	4.1	4.8	11.1	37.7

The stem height of pearl millet was observed to be maximum at 80% concentration of natural soil parameter (59cm) and chemical fertilizer (59cm) after 60 days of sowing.

Table 4. The fresh weight and dry weight of the stem (gm), under natural soil parameter (NPK) and chemical fertilizer NPK 10:26:26.

Concentration	Stem			
	Soil parameter		Chemical fertilizer NPK 10:26:26	
	Fresh wt (gm)	Dry wt(gm)	Fresh wt (gm)	Dry wt(gm)
Control	12.8	2.8	31.7	5.7
20%	19.2	3.1	36.8	4.5
40%	20	3.8	43	5.3
60%	22.1	4	50.1	5.9
80%	23.4	4.6	54.3	6.9
100%	12.3	2.2	30	4

The fresh wt. and dry wt. stem of pearl millet were observed to be maximum at 80% concentration of soil parameter (fresh wt =23.4 gm, dry wt. = 4.6 gm), under chemical fertilizer (fresh wt =54.3 gm, dry wt. = 6.9 gm) and minimum at 100% conc. of soil parameter under (fresh wt = 12.3 gm dry wt. 2.2gm) and under chemical fertilizer (fresh wt 30= gm, dry wt. = 4 gm).

Table 5. The root length (cm), under natural soil parameter and chemical fertilizer NPK 10:26:26, of pearl millet as influenced by different soil parameter after 60 days of sowing.

concentrations	Root length	
	Soil parameter	Chemical fertilizer
Control	37.9	38.3
20%	38.1	38.3
40%	38.7	40.2
60%	39.3	41.3
80%	40	42.5
100%	37	39.7

The root length was observed to be maximum at 80% concentration of soil parameter (root length=40cm) and under chemical fertilizer (root length=42.3 cm) and minimum at soil parameter (37cm) where as in case of chemical fertilizer the minimum root length (39.7 am) was observed at 100%.

Table 6. The fresh weight and dry weight of root (gm), under soil parameter and chemical fertilizer of pearl millet as influenced by different concentrations of parameter, after 60 days of sowing.

COCENTRATIONS	Root			
	Soil parameter		Chemical fertilizer	
	Fresh wt(gm)	Dry wt(gm)	Fresh wt(gm)	Dry wt(gm)
CONTROL	1.07	0.58	2.4	1.1
20%	1.14	0.59	2.76	1.16
40%	1.58	0.68	3.25	1.2
60%	1.75	0.8	3.9	1.3

80%	1.81	0.89	5.9	1.7
100%	0.96	0.57	2.30	1.02

Fresh wt. and dry wt. root were observed to be maximum at 80% con. of natural soil parameter (fresh = 1.81 gm, dry wt. = 0.89 gm), under chemical fertilizer (fresh wt. = 5.9 gm. dry wt.=1.7). Minimum at 100% con. of soil parameter under (fresh wt = 0.96 gm. dry wt. = 0.57 gm), under chemical fertilizer (fresh wt = 2.30 gm, dry wt. = 1.02 gm).

TABLE 7. The number of leaves, under soil parameter and chemical fertilizer NPK 10:26:26, of pearl millet as influenced by different concentration of soil parameter.

cocentrations	No. of leaves							
	Natural soil parameter				Chemical fertilizer NPK 10:26:26			
	15 th	30 th	45 th	60 th	15 th	30 th	45 th	60 th
	Day				Day			
control	3	4	5	7	4	4	6	8
20%	3	4	6	8	3	4	6	9
40%	3	4	6	8	3	4	6	9
60%	3	4	7	8	4	5	8	10
80%	3	4	8	9	3	5	9	11
100%	3	4	5	6	3	4	6	7

Number of leaves was observed to be maximum at 80% conc. of soil parameter (9) and chemical fertilizer (11), minimum at 100% conc. of soil parameter under (6) and chemical fertilizer (7).

Table 8. The collar diameter of stem (cm), under natural soil fertilizer and chemical fertilizer NPK 10:26:26, of pearl millet as influenced by different concentration of soil parameter.

concentrations	Collar diameter(cm)							
	Soil parameter				Chemical fertilizer			
	15 th	30 th	45 th	60 th	15 th	30 th	45 th	60 th
	Day				Day			
Control	1.05	1.39	1.78	2.86	1.09	1.62	2.6	4
20%	0.86	1.36	1.9	2.8	1.12	1.63	2.78	3.95
40%	0.889	1.38	1.98	2.73	1.15	1.66	2.77	3.86
60%	0.9	1.39	1.95	2.57	1.3	1.61	2.75	3.78
80%	0.89	1.6	2	2.52	0.94	1.36	2.72	3.71
100%	0.98	1.44	1.7	2.38	0.95	1.35	2.67	3

Collar diameter of stem observed to be maximum at control treatment under both with soil parameter (2.86cm) and chemical fertilizer (4 cm) after 60days of sowing, minimum at 100%conc. both with soil parameter (2.38cm) and chemical fertilizer (3cm) after 60 days of sowing.

Table 9.1 Internodal lengths (cm) of pearl millet as influenced by chemical fertilizer NPK 10:26:26 after 60 days of sowing.

concentrations	Internodal length (cm)									
	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th
Control	4.4	6.8	9.4	8.7	8.4	7	6.3	4.3		
20%	1.94	4.4	5.41	6.75	5.87	4.6	2.63	0.9	2.3	
40%	3.64	8.61	9.8	9.35	8.9	7.95	6.07	2.33	1.9	
60%	1.98	6.48	7.80	7.68	7.59	6.45	5.06	4.3	0.6	
80%	4.09	8.67	10.29	10.47	9.13	8.18	7.39	4.08	2.5	1.9
100%	5.2	8.25	8.17	8.06	8.18	6.72	5.4	4.4		

Internodal length observed to be maximum at control 80% under chemical fertilizer.

Table 9.2 Internodal lengths (cm) of pearl millet as influenced by natural soil parameter after 60 days of sowing.

concentrations	Internodal length (cm)									
	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th
control	2.37	3.29	4.07	4.4	4.56	3.3	5.95			
20%	1.6	6.14	7.07	7.2	7.4	6.5	4.1	5.35	2.7	
40%	3.83	6.16	8.5	8.19	5.07	4.4	5.75	3.8	2.5	
60%	5.46	6.88	7.19	8.18	9.4	8.39	8.18	7.5		
80%	3.98	7.97	8.76	10.45	9.6	6.7	6.36	2.4	8.5	
100%	1.67	3.91	4.16	6.7	4.99	2.78	2.4			

Internodal length observed to be maximum at control 80% under soil parameter

Conclusion

It is concluded that a) germination percentage of pearl millet decreased as the concentration of soil parameter increased i.e. i) 100 percent germination was observed under control and minimum under 100% concentration of soil parameter (NPK). ii) Plumule radicle ratio was recorded maximum at 40 percent and 60 percent and minimum at 100% concentration of soil parameter (NPK). iii) Fresh wt. and dry wt. of germinated seeding of pearl millet also increased as the conc. Soil parameter (NPK) increased up to 60% and decreased up to 100% concentration.

Vegetative growth increases with the increase in concentration of effluent upto 80%.

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