OPEN ACCESS Freely available online

ISSN: 0974-8369
Biology and Medicine

Research Article

Evaluation of Different Levels of Nutrient and Growth Regulators on Seed Protein, Seed Test Weight and Available Post-Harvest Soil Nutrient Status in Pearl Millet (*Pennisetum glaucum*) (L)

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ABSTRACT

Field trial was conducted to evaluate the levels of nutrients and growth regulators on quality of seed protein content, grain weight, and soil fertility status in pearl millet in rabi season of 2019-2021 at Department of Millets, Directorate of PB&G (Plant Breeding and Genetics), TNAU (Tamil Nadu Agricultural University), Coimbatore. The experiment was conducted for three years and ten treatments were tried with replicated thrice. Plant Growth regulator is a chemical substances that help for developing growth of plant, progress for high yield, get superior quality of grain. The treatment 125% Recommended dose of fertilizer with chlormequat chloride at 250 ppm) (parts per million) on 20 and 40 days after sowing recorded maximum grain protein content, test weight and nutrients uptake during the crop growing period. Simultaneously 125% Recommended dose of fertilizer with foliar applied chlormequat chloride (250 ppm) on 20th and 40th days after sowing was indicated more available soil nutrient status after harvest of the crop which was on par with 125% RDF (Recycling-Derived Fertilisers) + NAA (Naphthalene Acetic Acid) (250 ppm) at 20 and 40 Days after sowing and other Recommended fertilizer dose treatments. The treatments effects were influenced on protein content and test weight of pearl millet with nutrients and growth regulators. The response of pearl millet to applied nitrogen as well as PGRs can be attributed to the favourable effect on yield and yield-attributing characters. This should be due to the reason that nitrogen fertilizer leads to higher availability of nutrients to facilitate promotion of growth and development furthermore resulting in rising yield attributes and yield.

Keywords: Pearl millet; Plant Growth Regulators (PGRs); Test weight; Grain protein

INTRODUCTION

Pearl millet is a very important and potential cereal of dry and rainfed regions. In Indian condition we are the leading Pearl millet growing country, attributing forty two percent of global production. Indian context, it is principally grown as a rainfed crop in varied climatic condition. Cumbu is grown in 7.13 m.ha with 8.07 m.tons total production and crop productivity of 1132 kg/ha. (Season and Crop Report) [1]. In Indian continent Rajasthan, Maharashtra, Gujarat, UP and Haryana are predominant growing states.

Generally arid regions receive 10 percent of the total nutrients used in India, which consist about 1.4 million tons. Pearl millet yield is considered as low in our country generally owing to higher mortality and make use of lesser fertilizers. It uptakes 72.5 kg N, P_2O_5 and K_2O per hectare per annum, meanwhile just 10 to 20 kg of these through source of fertilizers. It is an efficient and important source of seed protein comprises high digestibility (12.61%) by faintly superior aminoacid, fat (5.1%), mainly iron (2.80%), carbohydrates (69.41%), mineral (2.31%), riboflavine (Vitamin B2) and niacin (Vitamin B4) [2]. Thus, there is a necessitate to advance fertility supervision with the optimal number of plant population for current hybrids to sustain in crop yield and per unit area productive capacity.

The PGRs contain possible for improving crop productivities in environmental stress. Growth regulators are chemical substances which will be modified the expansion of growth parameters and crop growing processes most important to increased yield, enhanced grain quality or make easy to harvest [3]. Application of PGRs have been descript to provoke physiologically efficient, including photosynthetic ability of crops and it was resulted in better growth and yield of a number of crops not including significant enhancement of cost of cultivation [4,5] ascribed that the growth regulators contain promising to increase crop production in environmental stress. In view of the aforesaid facts,

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Received: 12-Dec-2023, Manuscript No. BLM-23-24347; **Editor assigned:** 14-Dec-2023, Pre QC No. BLM-23-24347 (PQ); **Reviewed:** 28-Dec-2023, QC No. BLM-23-24347; **Revised:** 05-Jan-2024, Manuscript No. BLM-23-24347 (R); **Published:** 12-Jan-2024, DOI: 10.35248/0974-8369.23.15.630.

Citation: Guru G, Suresh G, Marimuthu M, Natarajan S, Ravichandran V. (2024) Evaluation of Different Levels of Nutrient and Growth Regulators on Seed Protein, Seed Test Weight and Available Post-Harvest Soil Nutrient Status in Pearl Millet (*Pennisetum glaucum*) (L). Bio Med. 15:630.

present study examined different levels of nutrient and plant growth regulators on quality as well as status of soil fertility after crop harvest.

MATERIALS AND METHODS

An experiment was conducted from 2019-2021 at Millets Farm, TNAU, Coimbatore in Rabi season for learning the significance of N level and crop growth regulators to asses grain proteins and soil nutrient position after harvest of Pearl millet crop. The farm location is positioned in 110 N latitude and 770 E longitudes and at altitude of 426.9 MSL. The field trials were laid out in RBD (Randomized Block Design) with 3 replications and 10 treatments *viz*. T1-125% RDF*, T2-100% RDF*, T3-75% RDF*, T4-125% RDF*+Foliar application of chlormequat chloride (250 ppm) at 20 and 40 DAS, T5-100% RDF*+Foliar application of chlormequat chloride (250 ppm) at 20 and 40 DAS, T6-75% RDF*+Foliar application of chlormequat chloride (250 ppm) at 20 and 40 DAS, T7-125% RDF*+Foliar application of NAA (40 ppm) at 20 and 40 DAS, T8-100% RDF*+Foliar application of NAA (40 ppm) at 20 and 40 DAS, T9-75% RDF*+Foliar application of NAA (40 ppm) at 20 and 40 DAS and T10–Control.

Crop had been grown with 45 × 15 cm spacing. Cumbu hybrid CO 9 selected to this trial and 5 kg per hectare seed rate was utilized. The main field soil was slight alkalinity (8.08), narrow EC (0.861 dsm^{-1}), sand clay loamy, less OC (0.591%), low, medium and high in available N, P_2O_5 and K_2O (260.1: 20.5: 694.3 kg ha^{-1}) respectively. Soil samples were collected and Nitrogen (N) estimated by method developed the scientists Subbiah and Asija [6]. By using spectrophotometer, soil available phosphorus was estimated and Potassium content in soil was analysed with neutral normal ammonium acetate extraction method by Flame Photometer (Stanford and English) which is indicated in kg ha^{-1} [7,8].

RESULTS

An assessment of data shown that influence of effect of PGRs and Nitrogen nutrient did have been significant effect on protein content, test weight and available nutrient status after harvest of Pearl millet.

The higher rate of N uptake by plant is more significantly on development parameters, yield and yield factors where produced higher grain and Stover yields. More accessible available Nitrogen, phosphorus and Pottasium (214 ha^{-1} N, 20.10 kg ha^{-1} P_2O_5 and 557.01 kg ha^{-1} K_2O) were received under 125% RDF+foliar application of chloromequat chloride (250 ppm) at 20 and 40 DAS which was on par with treatment T7 at 195 ha^{-1} N, 18.9 kg ha^{-1} P_2O_5 and 522.1 kg K_2O (Table 1). Improved Dry Matter Production (DMP) with higher nutrients applied were found owing towards impact of NPK in influencing the use of sunshine by the augmented dry production biomass and any insufficiency of nitrogen reduces the sunshine use efficiency or facilitate to photosynthetic activities [9,10].

In view of protein content and grain test weight, 125% RDF+chloromequat chloride (250 ppm) at 20 and 40 DAS (T4) resulted maximum grain protein content and test weight during the crop growing period. It might be due to combined application of nitrogenous and phosphates fertilizers with potassium rendered high value of grain and stover yield in Cumbu [11]. This may be for the reason that the fertilizers of nitrogen and phosphorus improved the N and P_2O_5 contents into seed besides creating a favourable situation in crop and more photosynthetically competence; it ideal for simultaneously more crop growth and yield. The development in growth characteristics through these PGRs appears has to be due to this role in changing a variety of physiological and metabolite processes in plant system [12]. The foliar applied chlormequat chloride and NAA promoted a positive influence on the development of the plant, when dry and environmental wet period temperature was happened in the growing time of pearl millet.

Maximum grain protein content (12.65%) and test weight (12.70 g) were recorded in application of 125% RDF+chloromequat chloride (250 ppm) at 20 and 40 DAS (T4) and it was at par with treatment T7 (Figures 1 and 2). It might be due to the discharge of nutrients in essential quantity on critical plant growth period at higher dose and moreover increased rate of photosynthesis activities and fasten the transport by the function of PGRs [13]. Whereas, Menon et al., [14] stated that improvement in dry biomass by PGRs owing to reduction during photorespiration, moreover, it is well structured reason that the dry matter accumulation was the difference between photosynthesis and respiration progression in the plant system [11]. Kumar et al., [15] detailed that foliar applied chlormequat chloride and NAA was show considerably influenced lying on growth characters like plant height, total number of tillers, DMP and chlorophyll content were recorded [13]. Additionally, a number of scientists, Sivakumar et al., [16] and Yadav et al., [17] in pearl millet, Perveen et al., in wheat [18], Chandrashekhara et al., [19] and Shewry et al., [20] in maize also can be stated considerable improvement in growth parameters in variety of crops suitable to appliance of PGRs. Knowles et al., [21] attributed positive persuade of PGRs on carbon cycle in crops through good quality of increasing in chlorophyll content leading to higher CO_2 fixation as well as in rate of photosynthesis.

Table 1: Evaluation of different nutrients and growth Regulators on available soil nutrients, percentage of protein and 1000 g grain weight.

Treatment	Soil nutrient status (kg/ha)			Protein (%)	Test weight (g)
	N	P	K		
T_1	219.1	15.1	504.2	12.32	11.22
T_2	200.2	18.6	480.1	12.15	10.22
T_3	194.9	14.8	452.1	10.02	10.63
T_4	214	20.1	557	12.65	12.7
T_5	208.3	18	492	12.17	12.36
T_6	179.2	14.3	479	10.13	11.55
T_7	195.5	18.9	522.1	12.21	12.39
T_8	201.3	15.6	468.2	12.51	11.73
T_9	182.8	17.9	432.2	10.31	11.35
T_{10}	123.6	12.7	404.3	9.33	9.21
S. Ed	9.19	0.79	22.87	0.55	0.56
Critical Difference (C.D at 5%)	19.32	1.64	48.03	1	NS

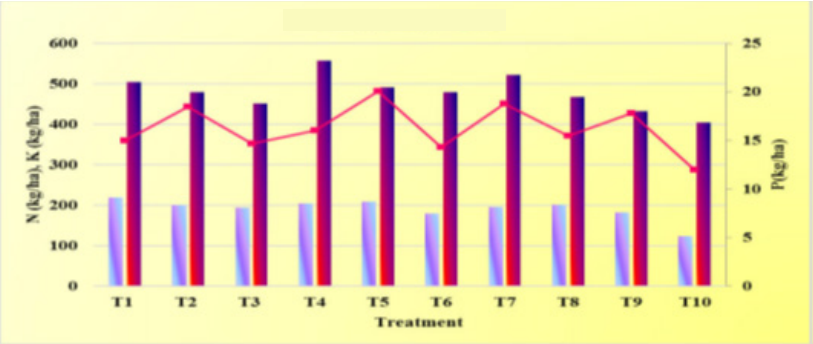

Figure 1: Evaluation of different Nutrients and PGRs on post-harvest soil nutrient status.
Note: ( ): N, ( ) : K, ( ) : P.

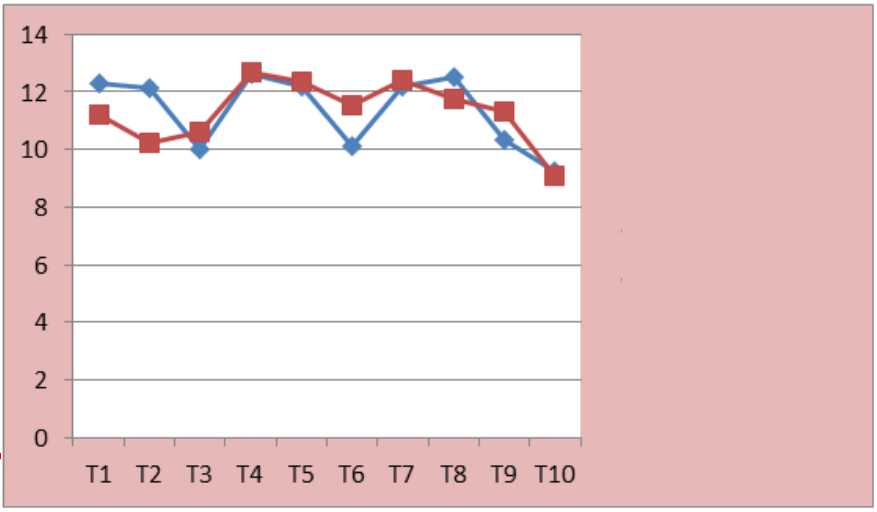

Figure 2: Evaluation of different Nutrients and Growth Regulators on protein content (%) of Pearl Millet Note: *80.0: 40.0: 40.0 kg of N, P_2O_5, and K_2O ha^{-1}.
Note: ( ): Protein, ( ) : Test weight.

DISCUSSION

The Plant Growth Regulators (PGRs) stimulate the natural growth regulatory systems rapid growth of the plant from germination of seed till the senescence. It improves the source and sinks relationship and promotes to stimulate the translocation of photosynthesis in formation of growth and development of seed resulting in superior crop productivity and improved grain quality Espindula et al., In distinguish to this; the lowest percentage of protein content, seed test weight and uptake of nutrients were recorded in reduced rate of recommended dose of nutrients applied treatment as well as in control. The treatment 125% Recommended dose of fertilizer with chlormequat chloride at 250 ppm on 20 and 40 Days after sowing recorded maximum grain protein content, test weight and nutrients uptake during the crop growing period. Thus, 125% Recommended dose of fertilizer with foliar application of chlormequat chloride (250 ppm) on 20th and 40th Days after sowing should be practiced for increasing grain quality, test weight and maximizing the yield.

CONCLUSION

125% RDF with foliar application of chlormequat chloride (250 ppm) on 20th and 40th days after sowing should be practiced for increasing grain quality, test weight and maximizing the yield.

Application of PGRs have been descript to provoke physiologically efficient, including photosynthetic ability of crops and it was resulted in better growth and yield of a number of crops not including significant enhancement of cost of cultivation and this study ascribed that the growth regulators contain promising to increase crop production in environmental stress. The treatment 125% Recommended dose of fertilizer with chlormequat chloride (250 ppm) on 20 and 40 Days after sowing recorded maximum grain protein content, test weight and nutrients uptake during the crop growing period.

ACKNOWLEDGEMENT

The authors are thankful to Director, Crop Management and Vice Chancellor, TNAU, Coimbatore, for providing all the facilities and financial support for this study and the support for conducting field study and analysis.

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