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# Effect of Moisture Conservation Practices on Nutrient Concentration, Uptake and Quality of Pearlmillet [*Pennisetum glaucum* (L.) R. Br. emend Stuntz] Hybrids

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**ABSTRACT**

A field experiment was conducted under loamy sand soil during two consecutive *kharif* seasons of 2018 and 2019 at Agronomy farm, S.K.N. College of Agriculture, Jobner, Jaipur to find out the best moisture conservation practices on nutrient concentration, uptake and quality of pearl millet [*Pennisetum glaucum* (L.) R. Br. emend Stuntz] hybrids. Hybrids *viz.,* RHB-173, RHB-177, MPMH-17 and HHB-67 in main plots and moisture conservation practices *viz.,* control, dust mulch, straw mulch, plastic mulch and seed line mulching of FYM in sub plots were tested using split plot design replicated four. Results showed that nitrogen, phosphorus and potassium concentration in grain and stover and protein content did not differ significantly due to pearlmillet hybrids but hybrid RHB-173 recorded significantly higher total nitrogen, phosphorus and potassium uptake as compared to MPMH-17 and HHB-67, remained at par with RHB-177 during both the years of study and in pool analysis. Results further indicated that application of straw mulch recorded significantly higher nitrogen, phosphorus and potassium concentration in grain and stover, total uptake and protein content over control, dust mulch and seed line mulching of FYM and statistically at par with plastic mulch during both the years of experimentation.

***Key words****: Pearlmillet, Hybrids, Moisture Conservation Practices, N, P, K and Protein*

## Introduction

Pearlmillet [*pennisetum glaucum* (L.) R.Br. emend Stuntz] is one of an important millet crop of India as well as Rajasthan. Pearlmillet is a short day, $C_4$ plant with high photosynthetic efficiency and dry matter production capacity adapted to hot climate. India is the largest producer of pearlmillet globally occupying 6.93 mha area with annual production of 8.61 mt and average productivity of 1243 kg/ha (Anonymous, 2018-19). Rajasthan rank first with respect to area and production of pearlmillet. Pearlmillet crop occupies and area of 4.2 lac ha and annual production of 5.05 mt with a productivity of 1190 kg/ha in Rajasthan (Anonymous, 2019-20). Pearlmillet hybrids play an important role in boosting crop productivity and the superiority of hybrids over varieties of pearlmllet has already been proved. Use of mulching in crop fields increases water use efficiency, protected against solar radiation, regulates soil temperature, suppress weed growth, minimizes leaching loss of nutrients, reduces soil erosion,

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checks excessive evaporation, increase infiltration of rain water and improve soil moisture, production and quality of field crops (Yaghi *et al.*, 2013 and Rummana *et al.*, 2018). Keeping above facts in view a field experiment was conducted to assess the role of moisture conservation practices on pearlmillet hybrids under semi arid conditions.

## Materials and Methods

A field experiment was conducted under loamy sand soil during two consecutive *kharif* seasons of 2018 and 2019 at Agronomy farm, S.K.N. College of Agriculture, Jobner, Jaipur Rajasthan (26° 05' N, 75° 20' E, 427 m above mean sea level). The soil of the experimental field was loamy sand with slightly alkaline in reaction pH 8.3. It was moderately fertile, being low in organic carbon (0.17%), low in available nitrogen (130.7 kg/ha), medium in available phosphorus (14.81kg/ha) and potassium (148.63 kg/ha). The experiment was carried out in split plot design comprising four Hybrids *viz.*, RHB-173, RHB-177, MPMH-17 and HHB-67 in main plots and five moisture conservation practices *viz.*, control, dust mulch, straw mulch, plastic mulch and seed line mulching of FYM in sub plots with four replications.

The recommended dose of fertilizers (RDF) for *kharif* pearlmillet in semi-arid eastern plain zone of Rajasthan is 60 kg N/ha and 30 kg $P_2O_5$/ha was given in the form of urea and SSP. Half of the nitrogen was applied at sowing time as basal dose along with the full quantities of phosphorus to all the plots. The remaining half dose of nitrogen was applied as top dressed in two splits through urea. The different weather parameters were recorded during crop growing period in both the years. The maximum and minimum temperature recorded during *kharif* season were in the rage of 30.0 to 42.8 °C and 19.1 to 27.6 °C in 2018 and 30.5 to 45.3 °C and 19.5 to 24.9 °C in 2019. The total rainfall received during *kharif* season was 307.2 mm in 2018 and 392 mm in 2019, respectively. The treatments wise moisture conservation practices were done in earmarked plots *i.e.* dust mulching done after each heavy rainfall by "*kassi*" upto a depth of about 4-5 cm, mustard straw mulch @ 5 t/ha (sun dried) was spread over the soil surface uniformly in between rows at 11 DAS, plastic mulch (0.05 mm thick) was placed in between the rows at 11 DAS and seed line mulching of FYM @ 2 t/ha over the soil surface uniformly in rows at 1 DAS. The crop was harvested at physiological maturity stage on 28 September, 2018 and 30 September, 2019. Data on estimation of nitrogen was done by colorimetric method using Nesslers reagent to develop colour (Snell and Snell, 1949). Phosphorus concentration in grain and stover was determined by Vanado-molybdo phosphate yellow colour method. Digestion of samples was done by tri-acid mixture (Jackson, 1967). Potassium concentration in grain and stover was determined by Flame photometer. Digestion of samples was done by tri-acid mixture (Jackson, 1973). Protein content in grain was calculated by multiplying nitrogen concentration in grain (%) with a factor 6.25 (A.O.A.C., 1960).

## Results and Discussion

### Effect of Hybrids

A critical analysis of data (Table 1 to 4) indicated that peal millet hybrids did not differ significantly in nitrogen, phosphorus and potassium concentration in grain and stover and protein content during both the years and in pooled analysis. The pearlmillet hybrid RHB-173 recorded the maximum total uptake of nitrogen, phosphorus and potassium which was at par with hybrid RHB-177 over MPMH-17 and HHB-67. On pooled mean basis, the RHB-173 recorded 12.0 and 22.3 per cent total nitrogen uptake, 10.6 and 21.6 per cent total phosphorus uptake and 9.3 and 22.6 per cent total potassium uptake higher over MPMH-17 and HHB-67, respectively. The results of the present investigation indicated differential behavior of pearlmillet hybrids with respect to nitrogen, phosphorus and potassium uptake and in showed conformity with findings of Sharma *et al.*, (2013) and Gupta *et al.*, (2016).

### Effect of Moisture Conservation Practices

An examination of data (Table 1 to 4) further indicated that application of straw mulch remained at par with plastic mulch and significant higher in nitrogen, phosphorus and potassium concentration of grain and stover and total uptake over control, dust mulch and seed line mulching of FYM during both the years of experimentation as well as on pooled basis. The pooled mean data application of straw mulch registered 57.0, 21.9 and 16.1 per cent total nitrogen uptake, 63.3, 20.9 and 17.5 per cent, total phosphorus uptake and 46.8, 15.7 and 14.3 per cent

total potassium uptake higher over control, dust mulch, and seed line mulching of FYM, respectively on pooled basis. All the moisture conservation practices significantly increased the protein content over control. The protein content registered with straw mulch was 17.6 and 9.5 per cent higher over control and dust mulch while remained at par with plastic mulch and seed line mulching of FYM, respectively on pooled basis. The increased uptake of nitrogen, phosphorus and potassium under moisture conser-

**Table 1.** Effect of moisture conservation practices on nitrogen concentration in grain and stover and total uptake by pearlmillet hybrids

| Treatments | N concentration (%) | | | | | | Total N uptake (kg/ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Grain | | | Stover | | | 2018 | 2019 | Pooled |
| | 2018 | 2019 | Pooled | 2018 | 2019 | Pooled | | | |
| Hybrids | | | | | | | | | |
| RHB-173 | 1.639 | 1.630 | 1.634 | 0.439 | 0.441 | 0.440 | 60.10 | 57.45 | 58.78 |
| RHB-177 | 1.668 | 1.660 | 1.664 | 0.450 | 0.452 | 0.451 | 59.13 | 57.15 | 58.14 |
| MPMH-17 | 1.619 | 1.600 | 1.609 | 0.433 | 0.434 | 0.433 | 54.06 | 50.89 | 52.48 |
| HHB-67 | 1.698 | 1.690 | 1.694 | 0.453 | 0.458 | 0.455 | 49.45 | 46.62 | 48.04 |
| SEm± | 0.04 | 0.04 | 0.03 | 0.01 | 0.01 | 0.01 | 1.23 | 1.77 | 1.21 |
| CD (P=0.05) | NS | NS | NS | NS | NS | NS | 3.94 | 5.68 | 3.59 |
| Moisture conservation practices | | | | | | | | | |
| Control | 1.510 | 1.493 | 1.502 | 0.414 | 0.408 | 0.411 | 41.58 | 38.70 | 40.14 |
| Dust mulch | 1.620 | 1.603 | 1.612 | 0.410 | 0.433 | 0.422 | 52.66 | 50.70 | 51.68 |
| Straw mulch | 1.790 | 1.738 | 1.764 | 0.478 | 0.477 | 0.478 | 64.70 | 61.34 | 63.02 |
| Plastic mulch | 1.720 | 1.713 | 1.717 | 0.463 | 0.460 | 0.462 | 64.06 | 61.33 | 62.69 |
| Seed line mulching of FYM | 1.640 | 1.678 | 1.659 | 0.454 | 0.451 | 0.453 | 55.44 | 53.08 | 54.26 |
| SEm± | 0.03 | 0.03 | 0.02 | 0.01 | 0.01 | 0.01 | 1.27 | 1.41 | 0.97 |
| CD (P=0.05) | 0.08 | 0.08 | 0.06 | 0.02 | 0.02 | 0.02 | 3.60 | 4.00 | 2.71 |
| CV (%) | 7.01 | 7.05 | 8.33 | 6.97 | 7.06 | 8.30 | 9.09 | 10.61 | 11.25 |

NS=Non significant

**Table 2.** Effect of moisture conservation practices on phosphorus concentration in grain and stover and total uptake by pearlmillet hybrids

| Treatments | P concentration (%) | | | | | | Total P uptake (kg/ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Grain | | | Stover | | | 2018 | 2019 | Pooled |
| | 2018 | 2019 | Pooled | 2018 | 2019 | Pooled | | | |
| Hybrids | | | | | | | | | |
| RHB-173 | 0.249 | 0.248 | 0.249 | 0.133 | 0.132 | 0.133 | 12.87 | 12.31 | 12.59 |
| RHB-177 | 0.253 | 0.252 | 0.253 | 0.135 | 0.134 | 0.135 | 12.66 | 12.25 | 12.45 |
| MPMH-17 | 0.249 | 0.244 | 0.247 | 0.132 | 0.131 | 0.132 | 11.74 | 11.02 | 11.38 |
| HHB-67 | 0.258 | 0.259 | 0.259 | 0.138 | 0.137 | 0.138 | 10.66 | 10.05 | 10.35 |
| SEm± | 0.006 | 0.006 | 0.005 | 0.003 | 0.003 | 0.002 | 0.34 | 0.53 | 0.35 |
| CD (P=0.05) | NS | NS | NS | NS | NS | NS | 1.08 | 1.68 | 1.04 |
| Moisture conservation practices | | | | | | | | | |
| Control | 0.229 | 0.228 | 0.229 | 0.117 | 0.116 | 0.117 | 8.63 | 8.10 | 8.37 |
| Dust mulch | 0.248 | 0.247 | 0.248 | 0.132 | 0.131 | 0.132 | 11.64 | 10.97 | 11.31 |
| Straw mulch | 0.269 | 0.268 | 0.269 | 0.147 | 0.146 | 0.147 | 13.90 | 13.43 | 13.67 |
| Plastic mulch | 0.260 | 0.259 | 0.260 | 0.142 | 0.141 | 0.142 | 13.77 | 13.23 | 13.50 |
| Seed line mulching of FYM | 0.255 | 0.254 | 0.255 | 0.135 | 0.134 | 0.135 | 11.98 | 11.29 | 11.63 |
| SEm± | 0.004 | 0.004 | 0.003 | 0.002 | 0.002 | 0.002 | 0.25 | 0.25 | 0.21 |
| CD (P=0.05) | 0.013 | 0.013 | 0.009 | 0.007 | 0.007 | 0.005 | 0.72 | 0.70 | 0.58 |
| CV (%) | 6.99 | 7.06 | 8.34 | 7.00 | 7.09 | 8.37 | 8.42 | 8.64 | 11.24 |

NS=Non significant

**Table 3.** Effect of moisture conservation practices on potassium concentration in grain and stover and total uptake by pearlmillet hybrids

| Treatments | K concentration (%) | | | | | | Total K uptake (kg/ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Grain | | | Stover | | | | | |
| | 2018 | 2019 | Pooled | 2018 | 2019 | Pooled | 2018 | 2019 | Pooled |
| Hybrids | | | | | | | | | |
| RHB-173 | 0.539 | 0.538 | 0.539 | 1.818 | 1.804 | 1.811 | 113.50 | 109.02 | 111.26 |
| RHB-177 | 0.547 | 0.546 | 0.547 | 1.828 | 1.824 | 1.826 | 111.55 | 109.25 | 110.40 |
| MPMH-17 | 0.536 | 0.534 | 0.535 | 1.807 | 1.795 | 1.801 | 104.44 | 99.03 | 101.74 |
| HHB-67 | 0.562 | 0.561 | 0.562 | 1.853 | 1.849 | 1.851 | 93.28 | 88.26 | 90.77 |
| SEm± | 0.012 | 0.013 | 0.010 | 0.041 | 0.043 | 0.033 | 2.46 | 2.48 | 1.95 |
| CD (P=0.05) | NS | NS | NS | NS | NS | NS | 7.86 | 7.93 | 5.80 |
| Moisture conservation practices | | | | | | | | | |
| Control | 0.509 | 0.507 | 0.508 | 1.732 | 1.719 | 1.726 | 82.26 | 77.83 | 80.05 |
| Dust mulch | 0.538 | 0.536 | 0.537 | 1.816 | 1.804 | 1.810 | 104.47 | 98.63 | 101.55 |
| Straw mulch | 0.575 | 0.573 | 0.574 | 1.914 | 1.908 | 1.911 | 118.66 | 116.34 | 117.50 |
| Plastic mulch | 0.563 | 0.561 | 0.562 | 1.849 | 1.846 | 1.848 | 117.48 | 114.11 | 115.80 |
| Seed line mulching of FYM | 0.547 | 0.545 | 0.546 | 1.822 | 1.815 | 1.819 | 105.60 | 100.03 | 102.81 |
| SEm± | 0.010 | 0.010 | 0.007 | 0.032 | 0.032 | 0.024 | 1.86 | 1.81 | 1.39 |
| CD (P=0.05) | 0.027 | 0.027 | 0.020 | 0.091 | 0.092 | 0.068 | 5.30 | 5.15 | 3.89 |
| CV (%) | 6.99 | 7.08 | 8.34 | 7.02 | 7.10 | 8.36 | 7.05 | 7.15 | 8.47 |

NS=Non significant

**Table 4.** Effect of moisture conservation practices on protein content of pearlmillet hybrids

| Treatments | Protein content (%) | | |
|---|---|---|---|
| | 2018 | 2019 | Pooled |
| Hybrids | | | |
| RHB-173 | 10.24 | 10.32 | 10.28 |
| RHB-177 | 10.43 | 10.51 | 10.47 |
| MPMH-17 | 10.12 | 10.13 | 10.12 |
| HHB-67 | 10.62 | 10.70 | 10.66 |
| SEm± | 0.23 | 0.25 | 0.19 |
| CD (P=0.05) | NS | NS | NS |
| Moisture conservation practices | | | |
| Control | 9.44 | 9.33 | 9.38 |
| Dust mulch | 10.13 | 10.02 | 10.07 |
| Straw mulch | 11.19 | 10.86 | 11.03 |
| Plastic mulch | 10.75 | 10.71 | 10.73 |
| Seed line mulching of FYM | 10.25 | 11.14 | 10.70 |
| SEm± | 0.18 | 0.18 | 0.14 |
| CD (P=0.05) | 0.52 | 0.52 | 0.38 |
| CV (%) | 9.44 | 9.33 | 9.38 |

NS=Non significant

vation treatments could be attributed to the increased concentration of nitrogen, phosphorus and potassium in grain and stover. Uptake of nutrients is the function of nutrient concentration and biomass production, the enhanced uptake of nutrients under various moisture conservation practices could be assigned to increased grain and stover yield of pearlmillet hybrids under these treatments. Increase in uptake of nitrogen, phosphorus and potassium were also recorded due to mulching treatments by Tetarwal and Rana, (2006), Mallareddy, (2016), Kanwar *et al.,* (2017), Lal, (2017) and Yadav, (2018).

## Conclusion

Based on results of two years experimentation, it may be concluded that hybrid RHB-173 recorded significantly higher total nitrogen, phosphorus and potassium uptake, being remained at par with RHB-177. Use of straw mulch proved to be the most suitable moisture conservation practices as it provided significantly higher nitrogen, phosphorus and potassium concentration in grain and stover and total uptake, being remained at par with plastic mulch over control, dust mulch and seed line mulching of FYM.

## References

A.O.A.C. 1960. *Official Method of Analysis.* 18th Edn. Association of Official Agricultural Chemists, Washington.

Anonymous. 2018-19. Government of India, Ministry of Agriculture & Farmers Welfare Department of Ag-

riculture, Cooperative & Farmers Welfare Directorate of Economics and Statistics. *Agricultural Statistics at a Glance* 56-57.

Anonymous. 2019-20. State level summary of principal crops in Rajasthan. Directorate of Agriculture, Pant Krishi Bhawan, Jaipur, Rajasthan.

Gupta, A., Sharma, O.P., Solanki, R.B. and Verma, H.P. 2016. Growth and yield of Pearlmillet [*Pennisetum glaucum* (L.).R. Br.] as influenced by varieties and bio-regulators. *Environment and Ecology.* 35(2): 785-788.

Jackson, M.K. 1973. *Soil Chemical Analysis.* Prentice Hall of India Pvt. Ltd., New Delhi.

Jackson, M.L. 1967. *Soil Chemical Analysis.* Prentice Hall of India Pvt. Ltd., New Delhi.

Kanwar, S., Gupta, V., Rathore, P.S. and Singh, S.P. 2017. Effect of soil moisture conservation practices and seed hardening on growth, yield, nutrient content, uptake and quality of pearl millet [*Pennisetum glaucum* (L.) R. Br.]. *Journal of Pharmacognosy and Phytochemistry*. 6(4): 110-114.

Lal, B. 2017. *Response of Sesame* [*Sesamum indicum* (L.)] *to vermicompost and moisture conservation practices.* M.Sc. (Ag.) Thesis, SKNAU, Jobner, Jaipur, Rajasthan, India.

Mallareddy, Thimmegowda, M.N and Satish, A. 2016. Effect of moisture conservation practices on rooting pattern and nutrient uptake of finger millet + pigeonpea intercropping system. *Ecology Environment & Conservation.* 22 : S 203-S 207.

Rummana, S., Amin., A.K.M.R., Ialam, M.S. and Faruk, G.H. 2018. Effect of irrigation and mulching materials on growth and yield of wheat. *Bangladesh Agronomy Journal.* 21(1) : 71-76.

Sharma, L.D. Singh, Yogendra and Sharma, Ramavtar 2013. All India Coordinated Research Project on Pearlmillet [*Pennisetum glaucum (L.*)], Notification of crop varieties and registration of germplasm. *Indian Journal of Genetics and Plant Breeding.* 73(2) : 228-231.

Snell, P.D. and Snell, G.T. 1949. *Colorimetric Methods of Analysis,* 3rd Edn. II D Van Nostrand Co., Inc. New York.

Tetarwal, J.P. and Rana, K.S. 2006. Impact of cropping system, fertility level and moisture conservation practices on productivity, nutrient uptake, water use and profitability of pearlmillet (*Pennisetum glaucum*) under rainfed condition. *Indian Journal of Agronomy.* 51(4): 263-266.

Yadav, S.K. 2018. *Effect of Moisture Conservation Practices and Zinc Fertilization on Growth, Yield and Quality of Pearlmillet [Pennisetum glaucum (L.) R. Br. emend Stuntz* ]. M.Sc. (Ag.) Thesis, SKNAU, Jobner, Jaipur, Rajasthan, India.

Yaghi, T., Arslan, A. and Naoum, F. 2013. Cucumber (*Cucumis sativus* L.) water use efficiency under plastic mulch and drip irrigation. *Agricultural Water Management.* 128 : 149-157.