Indian Journal of Agronomy **67** (4): 407–411 (December 2022)

Research Paper

Influence of the best management practices on performance of dual-purpose baby corn (*Zea mays*) under eastern Himalayas

RAKESH KUMAR[1], BIDYUT C. DEKA[2], A. THIRUGNANAVEL[3] AND PRAVIN KUMAR UPADHYAY[4]

ICAR Research Complex for North Eastern Hill Region, Nagaland Centre, Jharnapani 797 106, Nagaland

Received: October 2020; Revised accepted: October 2022

ABSTRACT

A field experiment was conducted during the winter (*rabi*) season of 2013–15 at the ICAR–Research Complex for North-Eastern Hill Region, Nagaland Centre, Jharnapani, Medziphema, Nagaland, to evaluate the effect of mulching, liming and integrated nutrition for maximizing the productivity of recently introduced crop baby corn (*Zea mays* L.) in the region. The results revealed that, use of straw mulches significantly increased the yield attributes of baby corn. Significantly higher yields of green baby cob (10.8 t/ha), baby corn (1.84 t/ha) and green fodders (34.65 t/ha) were recorded with application of 1.0 t lime/ha but was on a par with 0.5 t lime/ha. Similarly, higher yields of green baby cob (10.56 t/ha), baby corn (2.02 t/ha) and green fodder (34.95 t/ha) were noted with application of 100% recommended dose of fertilizer through inorganic sources (RDF (IN) + 25% RDF through organic sources (ON). Hence, use of straw mulch integrated with application of lime in furrow @ 1.0 t/ha along with 100% RDF (IN: N-P-K-S-Zn: represents 150-80-60-30-10 kg/ha) + 25% RDF (ON) may be adopted and promoted to achieve the maximum crop productivity of baby corn under the foot-hill condition of eastern Himalayas.

Key words: Baby corn, Economics, Green fodder, Integrated nutrient management, Lime, Mulches

Baby corn (*Zea mays* L.), being one of the most important dual-purpose crops, is grown round the year for dual purposes like production of green baby cob as well as green fodders in India (Kumar and Bohra, 2014). It has an edge over the other cultivated fodder crops owing to higher production potential, wider adaptability, fast growing in nature and having the excellent fodder quality (Kumar *et al.,* 2015a). Baby corn production has directly integrated with livestock sectors, because only~13–20% of fresh ear weight is used by human and rest can be used as excellent feed materials for mulch ruminants (Kumar *et al.,* 2015b). It is possible to produce about ~40–45 t/ha of fresh green fodder biomass in addition to its commercial green baby cob, which could raise the income by ₹ 40–45 × 10^3/ha. Recently introduced crop, baby corn is grown during the post-rainy/winter season experiences acute shortage of water deficits might be due to poor water-conservation measures during the crop production, which restricts to achieve the better crop productivity in the region (Kumar and Meena, 2016). Hence, application of straw mulch offers an opportunity to enhance the crop production, soil, and water conservations. Despite having lot of beneficial effects, adoption of straw mulch is not a commonly adopted practices among the farming community of regions due to lack of proper knowledge and awareness (Kumar *et al.*, 2016a). However, majority of the soil in this region are affected by extreme forms of soil acidity of *p*H< 5.5 (Kumar *et al*., 2012) and crop production on such problematic soil is mostly constrained by Al and Fe toxicity, P deficiency, and low base saturation, which impaired the biological activity (Singh *et al.*, 2014; Kumar *et al*., 2016b). In this case, application of lime along with farmyard manures (FYM) is a viable and potential options to increase the phyto-availability of nutrients and ameliorates soil acidity-induced fertility problems (Kumar and Meena, 2016). In the modern agricultural production system, integrated nutrient management (INM) takes care of crops nutritional demands and soil-fertility management, which leads to increased crop yields through judicious use of organic and inorganic nutrients. Beneficial effects of enriched compost, i.e. FYM and vermicompost, for improving the soil fertility and crop productivity is well documented. Since no earlier studies were done on benefits of straw mulch, liming and integrated nutrient management in

[4]Corresponding author's Email: pravin.ndu@gmail.com

[1]Senior Scientist (Agronomy), Division of Crop Research, ICAR Research Complex for Eastern Region, Patna, Bihar 800 014; [2]Vice Chancellor, Assam Agricultural University, Jorhat, Assam 785 013; [3]Senior Scientist (Horticulture), ICAR National Research Centre on Citrus, Nagpur, Maharashtra 440 033; [4]Scientist, Division of Agronomy, ICAR-Indian Agricultural Research Institute, New Delhi 110 002

baby corn under particular edapho-climatic conditions of eastern Himalaya, the present study was taken up.

MATERIALS AND METHODS

A field experiment was conducted at the ICAR Research Complex for North-Eastern Hills Region, Nagaland Centre, Jharnapani, Medziphema, Nagaland, during the winter *(rabi)* season of 2013–14 and 2014–15. The experimental location is situated at 25° 182 N, 83° 032 E and at an altitude of 78.1 m above mean sea-level. The soil of the experimental plot was sandy loam, acidic in nature (*p*H 5.42), medium in organic carbon (0.71%), available P (14.1 kg/ha) and low in available N (201.2 kg/ha) and K (173.2 kg/ha). The experiment was laid out in a split-plot design with 3 replications. Treatments comprised 2 levels of mulch, viz. control and straw mulch (2.5 t/ha) and level of lime in furrows, viz. control, 0.5 and 1.0 t/ha, in main-plot and 4 levels of integrated crop nutrition, i.e. control, 100% recommended dose of fertilizer through inorganic sources (RDF IN), 75% RDF through inorganic sources (IN) + 25% recommended dose of nitrogen (RDN) through organic sources (RDN ON) and 100% RDF (IN) + 25% RDN (ON) in subplot. In control treatment, use of straw mulch, lime and crop nutrients through inorganic and organic sources were not applied. Source of organic nitrogen (ON) was supplied through farmyard manures (FYM : 0.5% N, 0.2% P and 0.5% K) 30 days before sowing (DAS) the crop as per treatment. Lime was applied in furrow 2 before sowing as per treatment. Baby corn hybrid, 'HM 4' was sown at a spacing of 40 cm × 20 cm. Recommended dose of fertilizer through chemical fertilizers (RDF IN), i.e. N, P, K, S, Zn represents 150-80-60-30-10 kg/ha. Source of N was urea, whereas P, K, S and Zn were applied through diammonium phosphate (DAP), muriate of potash (MOP), elemental sulphur and zinc oxide (ZnO) respectively. Full doses of P, K, S and Zn and half doses of N were applied basal and remaining half doses of N were applied as top-dressed in 2 equal splits-at knee high (30–35 days after sowing) and tassel-emergence stages. Data on growth attributes, viz. plant height, green leaves, stem girth, dry matter, and root parameters, viz. root length, root volume and root dry weight, were recorded following the standard procedures at harvesting from randomly selected 5 plants from each plot. Similarly, yield attributes, viz. baby cob weight, baby corn weight; baby corn girth and length were recorded. Immature baby cobs were harvested within 2–3 days after silk emergence and baby cob yield was recorded. After the final cob picking, crop was harvested for green fodder and its yield was recorded. Baby cob, baby corn, green and dry fodder productivity were computed as per the formula of Kumar *et al.* (2015c):

$$\text{Baby cob/corn/fodder productivity (kg/ha/day)} = \frac{\text{Baby cob/corn/fodder yield (kg/ha)}}{\text{Total duration of crop (days)}}$$

The data were analyzed statistically. Significant difference between the treatments means were compared with critical differences at 5% level of probability (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Application of straw mulch resulted in increased the growth attributes, i.e. plant height, green leaves, stem girth and dry matter to the tune of 10.5, 18.5, 22.3 and 18%, respectively, over the control (Table 1). This might be owing to higher moisture status in soil for longer period in mulched plots (Kumar, 2015a). Increasing levels of applied lime from 0 to 1.0 t/ha resulted in significant increase in plant height, green leaves, stem girth and dry matter of baby corn. Application of 1.0 t lime/ha showed increase in these attributes to the tune of 8, 11, 22 and 13% compared to 0.5 t lime/ha. This might be owing to the fact that applied lime neutralizes the soil acidity and increases availability of P, suppress toxicity of Fe, Al, and Mn (Kumar and Meena, 2016). Application of integrated nutrition with 100% RDF (IN) + 25% RDN (ON) showed the taller crop plant, more green leaves, stem girth and dry matter and proved significantly better than 75% RDF + 25% RDN (ON) and 100% RDF (IN). Application of 100% RDF (IN) + 25% RDF (ON) increased these attributes to tune of 6.5, 7.7, 11.2, 3.7% and 7.5, 12.8, 9.1, 7.6% respectively, over 100% RDF (IN) and 75% RDF (IN) + 25% RDF (ON). This might be owing to recommended dose of fertilizers along with FYM resulted in higher nutrient uptake, as these release enough nutrients through mineralization (Kumar, 2015a).

Root attributes, i.e. root length, root weight and root volume, of baby corn were markedly higher with straw mulch. Application of straw mulch increased these attributes by 18.4, 18.7 and 22.3%, respectively, over the control (Table 1). This might be owing to the higher moisture status in the soil for prolonged periods in mulch plot (Kumar, 2015b). Application of 1.0 t lime/ha significantly increased, root length, root weight and root volume by 11, 11.3 and 22.1%, respectively, over 0.5 lime t/ha. This might be because of the acidification effect of rhizosphere through oxidation of lime, which mobilizes the considerable amount of P and it plays a major role in root development (Kumar *et al.*, 2015b). Significantly higher root length, root dry weight and root volume were recorded with application of 100% RDF (IN) + 25% (ON). Application of 100% RDF (IN) + 25% (ON) has shown enhancement in these attributes to the tune of 9.63, 8.1 and 11.2% and 10.2, 13.5, 9.1%, respectively, over 100% RDF (IN)

Table 1. Effect of the best management practices on growth and root attributes of baby corn (pooled data of 2 years)

Treatment	Growth attributes				Root parameters		
	Plant height (cm)	Green leaves/ plant (no.)	Stem girth/plant (cm)	Dry-matter/ plant (g)	Root length (mm)	Root dry weight/plant (g)	Root volume/plant (cc)
Moisture-conservation practices							
Control	157.72	13.06	1.84	127.21	14.96	16.75	27.32
Straw mulch	174.35	15.47	2.25	150.05	17.71	19.89	33.59
CD (P=0.05)	5.86	1.15	0.10	4.87	1.31	1.48	0.83
Liming (t/ha)							
Control	156.54	12.13	1.80	123.69	13.89	15.54	28.48
0.5	164.42	14.53	1.95	137.01	16.64	18.66	30.09
1.0	177.15	16.13	2.38	155.19	18.47	20.76	32.79
CD (P=0.05)	7.17	1.41	0.12	5.97	1.61	1.82	1.02
Integrated nutrition							
Control	150.74	12.53	1.75	123.86	14.35	16.05	28.23
100% RDF (IN)	168.00	14.69	2.05	143.51	16.82	18.87	30.22
75% RDF + 25% RDF(ON)	166.45	14.03	2.09	138.33	16.03	17.97	31.01
100% RDF (IN) + 25% RDF (ON)	178.95	15.82	2.28	148.82	18.14	20.39	32.36
CD (P=0.05)	5.6	1.07	0.16	4.48	1.23	1.39	1.15

Details of integrated nutrition are given under Materials and Methods

Table 2. Effect of the best management practices on yield attributes and yields of baby corn (pooled data of 2 years)

Treatment	Yield attributes					Yield parameters			
	Baby cob/plant (no.)	Baby cob weight/ plant (g)	Baby corn weight/ corn (g)	Baby corn girth/ corn (cm)	Baby corn length (cm)	Baby cob yield (t/ha)	Baby corn yield (t/ha)	Green fodder yield (t/ha)	Dry fodder yield (t/ha)
Moisture-conservation practices									
Control	2.16	28.21	5.95	2.97	9.40	8.50	1.44	28.19	6.29
Straw mulch	2.93	33.48	7.06	3.53	10.57	10.89	2.07	36.82	8.21
CD (P=0.05)	0.16	2.76	0.61	0.31	0.75	0.40	0.11	2.44	0.54
Liming (t/ha)									
Control	2.30	26.26	5.54	2.77	8.79	9.18	1.60	29.97	6.68
0.5	2.58	31.73	6.69	3.34	10.33	9.82	1.82	32.99	7.35
1.0	2.76	34.54	7.28	3.64	10.83	10.08	1.84	34.56	7.71
CD (P=0.05)	0.19	3.38	0.75	0.38	0.91	0.49	0.14	2.99	0.66
Integrated nutrition									
Control	2.23	27.14	5.71	2.85	8.82	9.64	1.48	29.62	6.61
100% RDF (IN)	2.64	31.30	6.57	3.28	10.25	9.91	1.80	32.99	7.35
75% RDF + 25% RDF (ON)	2.52	30.24	6.39	3.20	9.63	9.64	1.71	32.46	7.24
100% RDF (IN) + 25% RDF (ON)	2.80	34.71	7.34	3.66	11.23	10.56	2.02	34.95	7.80
CD (P=0.05)	0.13	2.42	0.52	0.27	0.70	0.37	0.11	1.84	0.41

Details of integrated nutrition are given under Materials and Methods

and 75% RDF (IN) + 25% RDF (ON). This might be owing to favourable effect of higher nutrition levels on soil bio-chemical conditions to root (Kumar, 2015b).

Use of mulch markedly influenced the baby corn yield attributes, i.e. baby cob (no.), weight of baby cob, baby corn, baby corn girth and corn length (Table 2). Application of straw mulch increased the number of baby cobs, weight of baby cob and baby corn, baby corn girth and corn length to the tune of 35.6, 18.7, 18.6, 18.9 and 12.4%, respectively, over the control. This might be attributed to higher water regime and better water balance, which leads to vigorous growth and produced more yield attributes in mulched plots (Kumar, 2015b). Similarly, number of baby cobs, weight of baby cob and baby corn, baby corn girth and corn were increased with the increasing levels of lime up to 1.0 t/ha. Application of 1.0 t lime/ha resulted in increase of these attributes over the control, but being on a par with 0.5 t/ha. However, applied lime in furrow @ 1.0 t/ha recorded increase in these attributes to the tune of 7, 8.9, 8.8,9 and 5% as compared to 0.5 t limes/ha. This might be owing to the fact that lime releases Ca^{2+}, which meets the demand, creates favourable condition for better uptake of P in the soil (Kumar and Meena, 2016). Further, application of integrated nutrition markedly influenced the number of baby cobs, weight of baby cob and baby corn, girth of baby corn and corn length. Application of 100% RDF (IN) + 25% RDF (ON) showed higher values of these attributes over 75% RDF + 25% RDN (ON) and 100% RDF (IN). Application of 100% RDF (IN) + 25% RDF resulted 6.1, 10.9, 11.7, 11.6 and 9.6% and 11.1, 14.8, 14.9, 14.4 and 16.6% increase in these attributes, respectively, over 100% RDF (IN) and 75% RDF (IN) + 25% RDF (ON). Improvement in yield attributes of crop might be attributed to the better nutrient availability and resulted in higher yield (Kumar, 2015b). Crop yield parameters, baby cob, baby corn, green fodder and dry fodder yields increased significantly with the use of straw mulch (Table 2). Application of straw mulch was increased of these attributes by 28, 44, 30.6 and 30.5%, respectively, over the control. This might be attributed to the higher moisture status, consequently better water balances in plant system at reproductive stage under the mulched plot, which resulted in higher growth and yield attributes of the crop (Jakhar *et al*., 2006; Sharma *et al*., 2010).

Thus, it can be concluded that newly introduced baby corn crop may be grown with use of straw mulch integrated with liming in furrow @ 1.0 t/ha and 100% RDF (IN) + 25% RDF (ON) to have maximum crop productivity under foot-hill condition of eastern Himalayas, India.

REFERENCES

Gomez, K.A. and Gomez, A.A.1984. Statistical Procedure for Agricultural Research, edn 2, pp. 241–271. Wiley, New York.

Jakhar, S.R., Singh, M. and Balai, C.M. 2006. Effect of farmyard manure, phosphorus zinc levels on growth, yield, quality, and economics of pearl millet (*Pennisetum glaucum* L.). *Indian Journal of Agricultural Sciences* **76**(1): 58–61.

Kumar, M., Hazarika, S., Choudhury, B.U., Ramesh, T., Verma, B.C., and Bordoloi, L. J. 2012. Liming and integrated nutrient management for enhancing maize productivity on acidic soils of northeast India. *Indian Journal of Hill Farming* **25**(1): 36–38.

Kumar, R. and Bohra, J.S. 2014. Effect of NPKS and Zn application on growth, yield, economics, and quality of baby corn. *Archives of Agronomy and Soil Science* **60**(9): 1,193–1,206, http://dx.doi.org/10.1080 /03650340.2013.873122

Kumar, R. and Meena, V.S. 2016. Towards the sustainable management of problematic soils in northeastern India. (In) *Conservation Agriculture: An Approach to Combat Climate Change in Indian Himalaya*. Bisht, J.K., Meena, V.S., Mishra, P.K. and Pattanayak, A. (Eds), ISBN: 978–981-10-2557-0, http://link.springer.com/book/10.1007/978-981-10-2558-7.

Kumar, R., Bohra, J.S., Kumawat, N. and Singh, A.K. 2015a. Fodder yield, nutrient uptake, and quality of baby corn (*Zea mays* L.) as influenced by NPKS and Zn fertilization. *Research on Crops* **16**(2): 243–249.

Kumar, R., Bohra, J.S., Kumawat, N., Kumar, A., Kumari, A. and Singh, A.K. 2016a. Root growth, productivity, and profitability of baby corn *(Zea mays* L.*)* as influenced by nutrition levels under irrigated ecosystem. *Research on Crops* **17**(1): 4–46.

Kumar, R., Bohra, J.S., Singh, A.K., and Kumawat, N. 2015b. Productivity, profitability, and nutrient-use efficiency of baby corn *(Zea mays)* as influenced of varying fertility levels. *Indian Journal of Agronomy* **60**(2): 285–290.

Kumar R, Kumar M and Deka BC.2015c. Production potential, profitability and energetics of transplanted rice as influenced by establishment methods and nutrient management practices in eastern Himalaya. *Research on Crops* **16**(4): 625–633.

Kumar, R., Patra, M.K., Thirugnanavel, A., Chatterjee, D. and Deka, B.C. 2016b. Towards the natural resource management for resilient shifting cultivation system in eastern Himalayas. Conservation Agriculture: An Approach to Combat Climate Change in Indian Himalaya, pp. 409–436. Bisht, J.K., Meena, V.S., Mishra, P.K. and Pattanayak, A. (Eds). http://link.springer.com/book/10.1007/978 -981-10-2,558-7.

Kumar, R. 2015a. Productivity, profitability, and nutrient uptake of maize *(Zea mays*) as influenced by management practices in North-East India. *Indian Journal of Agronomy* **60**(2): 273–278.

Kumar, R. 2015b. Influence of mulching, liming and farmyard manures on production potential, economics, and quality of maize (*Zea mays* L.) under rainfed condition of Eastern Himalaya. *Bangladesh Journal of Botany* **44**(3): 391–398.

Sharma, A.R., Singh, R., Dhyani, S.K. and Dube, R.K. 2010. Effect of live mulching with annual legumes on performance of maize (*Zea mays*) and residual effect on following wheat (*Triticum aestivum*). *Indian Journal of Agronomy* **55**(3): 177–184.

Singh, A.K., Singh, P.K., Kumar, Manoj, Bordoloi, L.J. and Jha, A.K. 2014. Nutrient management for improving mungbean [*Vigna radiata* (L.) Wilczek] productivity in acidic soil of Northeast India. *Indian Journal of Hill Farming* **27**(1): 37–41.