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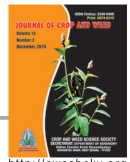

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Quality and green fodder productivity of forage maize (*Zea mays* L.) as influenced by different seed priming techniques under rainfed situation

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ABSTRACT

One field experiment was conducted to study the effect of different seed priming techniques on forage maize (Zea mays L.) var. J-1006 under rainfed situation during kharif seasons of 2016, 2017 and 2018 at Central Research Farm (CRF), BCKV, Gayeshpur, Nadia in new alluvial zone of West Bengal, India with nine treatments i.e., priming with water for 6 and 12 hrs., priming with $ZnSO_4$ @ 0.5% for 6 and 12 hrs., priming with KNO_3 @ 0.5% for 6 and 12 hrs. and lastly priming with KH_2PO_4 @ 0.5% for 6 and 12 hrs. and one Control (no priming treatment). The experimental design was Randomized Block Design (RBD) comprising of three replications. Results revealed that seeds primed with KNO_3 @ 0.5% for 12 hrs recorded the highest germination %, plant height, no. of leaves plant^{-1}, leaf: stem, green fodder productivity and dry matter yield, crude protein yield, crude protein percentage, acid detergent fiber, in vitro dry matter digestibility, neutral detergent fiber. Different seed priming techniques increased the forage and crude protein yield of maize var. J-1006 by 31.07% and 69.73 % respectively over control. Based on the pooled analysis of 3 years of filed experimentation, forage maize seed priming with KNO_3 @ 0.5% for 12 hrs may be recommended due to highest green forage productivity (445.8 q ha^{-1}) and higher crude protein yield (12.9 q ha^{-1}) as well as highest B:C ratio (3.12) under rainfed situation.

Key words: Acid detergent fiber, crude protein yield, fodder maize, green forage productivity, seed priming

Forage crops are mainly cultivated for grazing purposes by livestock and used as animals feed or stored as silage or hay to help meet production targets for traits like growth or weight gain, and to make up for seasonal feed demand and supply shortfalls. India being the largest milk producing country in the world has specific benefit in providing food security, nutritional security and economic returns to world's population. Green forage is an essential component in feeding of dairy cattle for economic milk production. Since green fodder is rich source of carotene, and it is the precursor of 'vitamin A' that involves in maintenance of integrity of epithelial cells lining the reproductive tract. The milk production in our country was 146.3 million tonnes in 2014-15 and now the country's milk output grew to the tune of 198.4 million tonnes in 2019-20 (Economic Survey, 2019-20). It further stated that, according to a study undertaken by the NDDB (National Dairy Development Board), the expected demand for milk and its products in 2030 in India will be 266.5 million metric tonnes. About 57 percent of overall consumption is consumed in rural areas. Even in 2030, per capita consumption under urban areas (592 ml) is expected to be greater than in rural sectors (404 ml). Maize is considered to be one of the ideal forage cereal crops for its rapid growth, produces high palatable biomass grown during summer and rainy seasons. It helps to improve body weight and quality of milk in cattle due to higher nutritional value (Chaudhary *et al*, 2016). However, to provide gainful employment and doubling the farmer's income, maize holds the higher potential. Forage maize crop can be used as a basic raw material for the manufacturing of oil, protein, starch, food sweeteners, alcoholic drinks and more recently, bio-fuel, in addition to being a staple crop for people and providing high-quality feed for livestock. The production of forage maize constitutes a fast way for obtaining high bio-mass production ideal for animal feeding as fresh green forage or as silage (Amodu *et al.*, 2017). Besides crop improvement, it is also involved in development of location-specific/climate resilient technologies for improved production and protection practices (Schwap *et al.*, 2019). Green forage of maize is an energy-rich feed for livestock. Maize is a viable crop in India, with a significant role in human food (25 %), poultry feed (49 %), livestock feed (12 %), industrial products (mostly starch) (12 %), and 1% each in brewing and grain production (Dass *et al.*, 2009 and Kundu *et al.*, 2020). Among the limiting factors some are adequate fertiliser quantity and ratio, irrigation water management, plant protection, and proper seed germination, as well as good seedling establishment at

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the time of planting. Seeds that germinate quickly create viable seedlings that are not reliant on rapidly dwindling soil moisture, as in rainfed systems. Soaking of seeds in water before sowing operation gives them a head start and speeds up seedling establishment, resulting in higher survival rates and yields. Seed priming method improved the mobilization of seed food stores to the expanding embryo during germination. In germinating seed, fatty acids, amino acids, carbohydrates and inorganic nutrients are all mobilized at varying rates. Actually seed priming (pre-sowing seed soaking) is a low-cost technique for achieving better plant stand and crop production. It increases the percentage of seedlings that germinate and promotes seedling establishment by pre-starting metabolic activities before the radicle emerges (Khan *et al.,* 2011). Seeds soaked in KNO_3, KH_2PO_4, Na_2HPO_4, $ZnSO_4$, or plain water before to planting have been found to accelerate seed germination percentage, improved seedling vigour, and root development early in the season, which results in strong plant establishment, drought tolerance, and crop output (Banerjee *et al*., 2020). As a result, the current field experiment was conducted to determine a suitable seed priming strategy to improve the green forage output and quality of forage maize in a rainfed environment.

MATERIALS AND METHODS

The field experiment was undertaken at Central Research Farm (CRF) of Bidhan Chandra Krishi Viswavidyalaya (BCKV), Gayeshpur, Nadia, West Bengal during kharif season of 2016, 2017 and 2018.The experimental field represented a humid and sub-tropical condition and typical medium land under New Alluvial Zone (NAZ) of West Bengal. The research station is situated at 22^O87'N latitude and 88^O20'E longitude and the elevation of 9.75 m above the mean sea level (approximately). The average rainfall is 1440 mm, with 75.5 % of it falling from June to September. The temperature starts to climb around the end of February and continues to rise through April and May. From June through October, the relative humidity remains high. During the crop growing season, average maximum temperatures ranged from 30.51 to 35.72°C, with minimum temperatures ranging from 25.32 to 27.42°C. The average maximum relative humidity ranged from 89.1 to 98.3 %, while the average lowest relative humidity was 42.5 to 89.9 %. The topography of land is medium land and the soil texture was sandy clay loam belonging to the order inceptisol and with *p*H 6.59. Soil had N: 198.5 kg ha^{-1} (Macro Kjeldhal method), P_2O_5: 47.3 kg ha^{-1} (Olsen's method), K_2O: 196.5 kg ha^{-1} (Flame photometer method) and organic carbon 0.53% (Walkley and Black's rapid titration method). Soil of this zone is mostly fertile, deep and almost neutral in reaction developed from recent alluvium of the river Ganges.

This field experiment was laid out in randomized complete block design (RCBD) with 9 different seed priming treatments *i.e.*,T_1- Priming with water for 6 hrs., T_2- Priming with water for 12 hrs., T_3- Priming with $ZnSO_4$ @ 0.5% for 6 hrs., T_4- Priming with $ZnSO_4$ @ 0.5% for 12 hrs., T_5- Priming with KNO_3 @ 0.5% for 6 hrs., T_6- Priming with KNO_3 @ 0.5% for 12 hrs., T_7- Priming with KH_2PO_4 @ 0.5% for 6 hrs., T_8- Priming with KH_2PO_4 @ 0.5% for 12 hrs. and T_9- Control (no priming) and the treatments were replicated thrice. Observations on germination percentage, green forage yield, quality parameters and production economics of forage maize (variety: J-1006) were recorded at regular interval. The maize was sown in 30 cm apart lines using 75 kg seed ha^{-1}. Statistical analysis was performed to determine the standard error of the mean (S. Em+) and the value of the CD (Critical difference) at a 5% level of significance, according to Gomez and Gomez methodology (1984).

RESULTS AND DISCUSSION

Influence of seed priming on germination percentage

Different seed priming procedures had a big impact on the germination of fodder maize seed. At 10 days after sowing, the value of germination percentage of feed maize cultivated during the *kharif* seasons of 2016, 2017, and 2018 was measured. It was revealed from the Table 1 that among the different seed priming treatments, the treatment T_6, where seed priming was done with KNO_3 @ 0.5% for 12 hrs. substantially was proved better than other treatments with respect to germination percentage (89.9%) at 10 DAS. It was statistically at par with the treatment T_3 where seed priming was done with $ZnSO_4$ @ 0.5% for 6 hrs. (89.2%) at 10 DAS. The lowest germination percentage (79.9%) at 10 DAS was obtained from the treatment T_9 *i.e.* no seed priming (Control). The enhancement of seed viability was more noticeable when seed priming was carried out through KNO_3 @ 0.5% for 12hrs. due to activation of antioxidant enzymes than other priming treatments. This result is in conformity with the findings of Kale and Takawale (2019) and they reported that priming treatment with KNO_3 at 1% concentration showed the best efficiency for the improvement of naturally aged seed that can be beneficial for re-storing seed viability of gene bank collections.

Influence of seed priming on plant height, no. of leaves plant^{-1} and leaf-stem ratio

The increased height of plant, fresh and dry weight of forage maize were positively influenced by different

Table 1: Growth parameters of forage maize as influenced by different techniques of seed priming (pooled value of 3 years)

Treatments	Germination % at 10 DAS	Plant height (cm)	No. of leaves plant^{-1}	Leaf :Stem
T_1	85.7	229.2	14.1	1.52
T_2	83.3	250.6	13.5	1.69
T_3	89.2	253.5	14.0	1.20
T_4	87.9	246.1	13.3	1.18
T_5	87.6	242.6	13.9	1.27
T_6	89.9	262.8	14.7	1.78
T_7	85.5	257.6	14.2	1.72
T_8	85.9	245.4	13.8	1.38
T_9	79.9	222.6	13.2	1.09
SEm (±)	**0.62**	**1.12**	**0.11**	**0.08**
LSD(0.05)	**1.86**	**3.36**	**0.33**	**0.24**

[T_1- Priming with water for 6 hrs., T_2- Priming with water for 12 hrs., T_3- Priming with $ZnSO_4$ @ 0.5% for 6 hrs., T_4- Priming with $ZnSO_4$ @ 0.5% for 12 hrs., T_5- Priming with KNO_3 @ 0.5% for 6 hrs., T_6- Priming with KNO_3 @ 0.5% for 12 hrs., T_7- Priming with KH_2PO_4 @ 0.5% for 6 hrs., T_8- Priming with KH_2PO_4 @ 0.5% for 12 hrs. and T_9- Control (no priming)]

Table 2: Yield and quality of forage maize as influenced by different techniques of seed priming (pooled value of 3 years)

Treatments	Green fodder yield (q ha^{-1})	Dry matter yield (q ha^{-1})	Crude protein yield (q ha^{-1})	Dry matter percentage (%)	Crude protein percentage (%)	Production efficiency (q ha^{-1}day^{-1})
T_1	342.3	78.9	8.8	23.2	9.6	5.7
T_2	356.6	83.6	7.8	23.6	9.2	5.9
T_3	369.7	87.4	9.8	23.7	11.1	6.1
T_4	351.1	85.3	9.8	24.3	11.5	5.8
T_5	345.9	83.2	7.6	24.1	8.8	5.7
T_6	445.8	104.8	12.9	23.5	12.3	7.4
T_7	401.8	94.1	7.9	23.2	11.3	6.7
T_8	399.9	90.8	10.1	22.8	10.9	6.6
T_9	340.1	78.6	7.4	22.6	8.4	5.6
SEm (±)	**3.24**	**1.52**	**0.38**	**0.3**	**0.37**	**0.20**
LSD(0.05)	**9.72**	**4.56**	**1.14**	**0.9**	**1.11**	**0.59**

[T_1- Priming with water for 6 hrs., T_2- Priming with water for 12 hrs., T_3- Priming with $ZnSO_4$ @ 0.5% for 6 hrs., T_4- Priming with $ZnSO_4$ @ 0.5% for 12 hrs., T_5- Priming with KNO_3 @ 0.5% for 6 hrs., T_6- Priming with KNO_3 @ 0.5% for 12 hrs., T_7- Priming with KH_2PO_4 @ 0.5% for 6 hrs., T_8- Priming with KH_2PO_4 @ 0.5% for 12 hrs. and T_9- Control (no priming)]

techniques of seed priming. Plant growth was increased due to seed priming because it generated healthy seedlings and gave them a head start for crop emergence because of more respiration and metabolism of carbohydrate in primed seedling resulted in enhancing dry matter accumulation and yield of crop. Plant height is a key factor in determining the amount of growth achieved throughout the growing season in order to maximize crop output. T_6, *i.e.* seed priming with KNO_3 @ 0.5 per cent for 12 hrs. yielded the greatest results in case of plant height (262.8 cm), number of leaves per plant (14.7), and leaf-stem ratio (1.78) in this experiment (Table 1), because it generated strong seedlings and gave seedlings a jump start on development. Improved plant weight was occurred from increased respiration and glucose metabolism in seedlings that emerged from primed seed. It is followed by T_7 *i.e* where seed priming was done with KH_2PO_4 @ 0.5% for 6 hrs. for plant height (257.6 cm), number of leaves per plant (14.2) and leaf-stem ratio (1.72). The lowest value of plant height (222.6 cm) as well as number of leaves per plant (13.2) and leaf-stem ratio (1.09) was recorded from T_9 control (no

Table 3: Acid Detergent Fibre (ADF) (%), Neutral detergent fibre (NDF) (%), In-vitro dry matter (%) and Dry matter digestibility (DDM) (q ha^{-1}) of forage maize as influenced by different techniques of seed priming (pooled value of 3 years)

Treatments	Acid Detergent Fiber (ADF) (%)	Neutral Detergent Fiber (NDF) (%)	In-vitro dry matter digestibility (IVDMD) (%)	Dry matter digestibility (DDM) (q/ha)
T_1	38.4	70.8	64.1	43.6
T_2	39.2	71.7	65.1	44.9
T_3	39.6	72.4	65.8	45.1
T_4	39.1	71.5	64.9	44.3
T_5	38.5	70.9	64.3	44.2
T_6	40.3	73.3	67.9	46.1
T_7	40.1	72.9	67.6	45.8
T_8	39.8	72.6	66.9	45.5
T_9	38.1	70.2	63.8	43.2
SEm (±)	**0.23**	**0.31**	**0.49**	**0.29**
LSD(0.05)	**0.69**	**0.90**	**1.44**	**0.84**

T_1- Priming with water for 6 hrs., T_2- Priming with water for 12 hrs., T_3- Priming with $ZnSO_4$ @ 0.5% for 6 hrs., T_4- Priming with $ZnSO_4$ @ 0.5% for 12 hrs., T_5- Priming with KNO_3 @ 0.5% for 6 hrs., T_6- Priming with KNO_3 @ 0.5% for 12 hrs., T_7- Priming with KH_2PO_4 @ 0.5% for 6 hrs., T_8- Priming with KH_2PO_4 @ 0.5% for 12 hrs. and T_9- Control (no priming)]

Table 4: Nutrient uptake of forage maize as influenced by different techniques of seed priming (pooled value of 3 years)

Treatments	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})
T_1	172.17	37.79	188.47
T_2	175.27	41.89	198.27
T_3	197.79	42.19	223.32
T_4	181.89	39.93	197.06
T_5	179.92	37.27	189.78
T_6	215.19	47.29	235.30
T_7	211.89	45.92	229.92
T_8	201.98	43.39	227.11
T_9	172.09	36.39	179.43
SEm (±)	**1.98**	**0.85**	**3.24**
LSD (0.05)	**5.94**	**2.55**	**9.72**
Initial value	**198.5**	**47.3**	**196.5**

[T_1- Priming with water for 6 hrs., T_2- Priming with water for 12 hrs., T_3- Priming with $ZnSO_4$ @ 0.5% for 6 hrs., T_4- Priming with $ZnSO_4$ @ 0.5% for 12 hrs., T_5- Priming with KNO_3 @ 0.5% for 6 hrs., T_6- Priming with KNO_3 @ 0.5% for 12 hrs., T_7- Priming with KH_2PO_4 @ 0.5% for 6 hrs., T_8- Priming with KH_2PO_4 @ 0.5% for 12 hrs. and T_9- Control (no priming)]

priming). Plants grown from primed seed had more leaves and seedling length than plants derived from unprimed seed as reported by Hassanpouraghdam *et al.* (2009).

Influence of seed priming on green forage yield and production efficiency

Among nine different priming treatments, the highest green forage yield (445.8 q ha^{-1}) was recorded from T_6 *i.e* seed priming with KNO_3 @ 0.5% for 12 hrs. and followed by treatment T_7 *i.e* where seed priming was done with KH_2PO_4 @ 0.5% for 6 hrs for green forage yield (401.8 q ha^{-1}). The minimum value of green forage yield (340.1 q ha^{-1}) was obtained from T_9 *i.e* no seed priming (control) (Table 2). Similar finding was recorded by Srivastava *et al.* (2017) and they concluded that seed priming with KNO_3@ 0.5% for 12 hrs. shows better germination percentage, higher plant height which

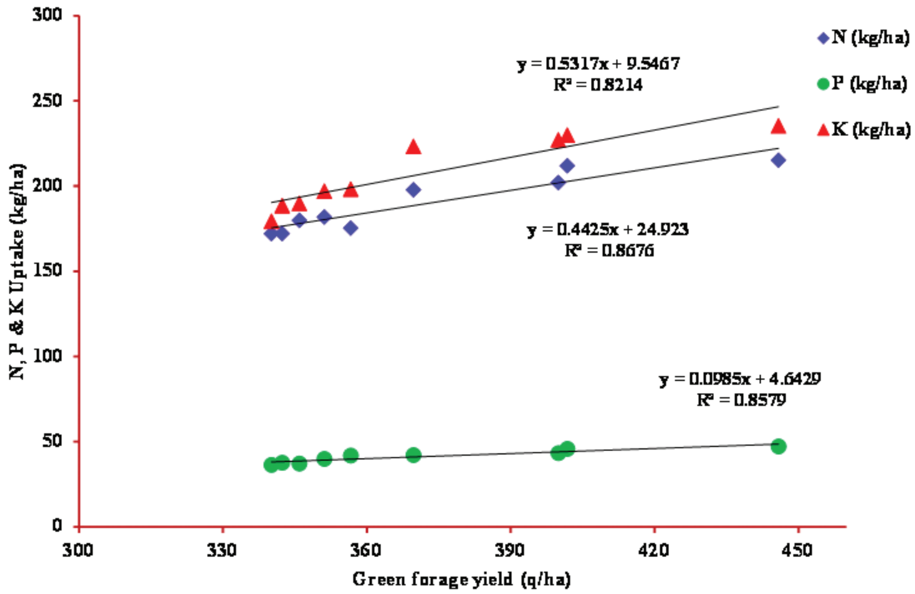

Fig 1: Correlation between N, P and K uptake (kg ha^{-1}) and green forage yield (q ha^{-1})

Table 5: Production economics and B-C ratio of forage maize cultivation as influenced by different techniques of seed priming (pooled value of 3 years)

Treatments	Cost of cultivation (Rs ha^{-1})	Gross monetary return (Rs. ha^{-1})	Net monetary return (Rs. ha^{-1})	Benefit- cost ratio
T_1	18676	44954	26277	2.40
T_2	19016	45999	26982	2.41
T_3	20468	50806	30337	2.48
T_4	20095	41919	21823	2.08
T_5	20086	45248	25162	2.27
T_6	21052	65521	44469	3.12
T_7	20197	54302	34104	2.64
T_8	20296	55830	35534	2.74
T_9	19261	45028	25766	2.33

[T_1- Priming with water for 6 hrs., T_2- Priming with water for 12 hrs., T_3- Priming with $ZnSO_4$ @ 0.5% for 6 hrs., T_4- Priming with $ZnSO_4$ @ 0.5% for 12 hrs., T_5- Priming with KNO_3 @ 0.5% for 6 hrs., T_6- Priming with KNO_3 @ 0.5% for 12 hrs., T_7- Priming with KH_2PO_4 @ 0.5% for 6 hrs., T_8- Priming with KH_2PO_4 @ 0.5% for 12 hrs. and T_9- Control (no priming)
The cost of cultivation was calculated as per the local labour and input cost norm.
[Price of Green fodder of maize: Rs. 150/- per Q]

was promotes in more green forage production. So that these techniques can help to a farmer to sustain their livestock's and generate good remuneration. The best result of production efficiency (7.4 q ha^{-1}day^{-1}) was recorded from T_6 *i.e* seed priming with KNO_3 @ 0.5% for 12 hrs. It is followed by T_7 *i.e* seed priming with KH_2PO_4 @ 0.5% for 6 hrs. and it was statistically at par with T_8 *i.e* seed priming with KH_2PO_4@ 0.5% for 12 hrs. obtained the value of 6.6 q ha^{-1}day^{-1}. The lowest value of production efficiency (5.66 q ha^{-1}day^{-1}) was obtained from T_9 *i.e* no priming (control).

Influence of seed priming on dry matter percentage and dry matter yield

Treatment T_4 *i.e* seed priming with $ZnSO_4$@ 0.5% for 12 hrs. recorded significantly higher dry matter percentage (24.3%) and it was statistically at par with T_5 where seed priming was done with KNO_3 @ 0.5% for 6 hrs. The lowest dry matter percentage (22.6%) was recorded from T_9 *i.e* no priming (control). The best result of dry matter yield (104.8 q ha^{-1}) was primarily because of higher dry biomass yields recorded from T_6 *i.e* seed priming with KNO_3 @ 0.5% for 12 hrs. and followed by treatment T_7 *i.e* where seed priming was done with KH_2PO_4 @ 0.5% for 6 hrs. for dry matter yield (94.1q ha^{-1}). The minimum value of dry matter yield (78.6 q ha^{-1}) was obtained from T_9 *i.e* no seed priming (control) (Table 2). Similar finding was recorded by Srivastava *et al.* (2017).

Influence of seed priming on crude protein percentage and crude protein yield

The highest value of crude protein percentage (12.3%) was recorded from T_6 *i.e* seed priming with KNO_3 @ 0.5% for 12 hrs. over other treatments which was statistically at par with T_4 *i.e* seed priming with $ZnSO_4$ @ 0.5% for 12 hrs. (Table 2). The lowest value of crude protein percentage (8.4%) was obtained from T_9 *i.e* no seed priming (control). Highest value of crude protein percentage was recorded from the seed priming with $ZnSO_4$ @ 0.5% for 12 hrs. as reported by Haris *et al.* (2011). Among nine different priming treatments, the best result of crude protein yield (12.9 q ha^{-1}) was primarily because of higher dry biomass yields recorded from T_6 *i.e* seed priming with KNO_3 @ 0.5% for 12 hrs. and followed by treatment T_8 *i.e* seed priming with KH_2PO_4 @ 0.5% for 12 hrs. for crude protein yield (10.1 q ha^{-1}). The minimum value of crude protein yield (7.4 q ha^{-1}) was obtained from T_9 *i.e* no seed priming (control) (Table 2).

Influence of seed priming on ADF (%), NDF (%), IVDMD (%) and DDM (%)

Treatments T_6 *i.e* seed priming with KNO_3 @ 0.5% for 12 hrs. has recorded significantly higher value of acid detergent fibre (ADF) (40.3%). It was statistically at par with T_7 *i.e* seed priming with KH_2PO_4@ 0.5% for 6 hrs. obtaining the value of 40.1% and the lowest value (38.1%) was obtained from T_9 *i.e* control (no priming) (Table 3). Whereas for neutral detergent fibre (NDF%) the highest value (73.3 %) was recorded from T_6 where seed priming was done with KNO_3 @ 0.5% for 12 hrs. over rest of the treatments. The lowest value of neutral detergent fibre (70.2%) was obtained from T_9 *i.e* no seed priming (control). The best value of 67.9% and 46.1% have been recorded for In-vitro dry matter digestibility (IVDMD) (%) and dry matter digestibility (DDM %), respectively from T_6 *i.e* seed priming with KNO_3 @ 0.5% for 12 hrs. and lowest value has been obtained for In-vitro dry matter digestibility (IVDMD) (%) and dry matter digestibility (DDM %) of 63.8% and 43.2%, respectively from T_9 *i.e* control (no priming).

Nutrient uptake at harvest

Treatment T_6 *i.e* seed priming with KNO_3@ 0.5% for 12 hrs. recorded significantly higher nitrogen uptake (215.19 kg ha^{-1}) which was followed by T_7 *i.e* seed priming with KH_2PO_4@ 0.5% for 6 hrs., whereas lowest value of nitrogen uptake (172.09 kg ha^{-1}) was recorded from T_9 *i.e* control (no priming) (Table 4). For phosphorus and potassium higher value was recorded from T_6 *i.e* seed priming with KNO_3 @ 0.5% for 12 hrs. obtaining vale of 47.29 kg ha^{-1} and 235.30 kg ha^{-1}, respectively. The lowest value of phosphorus (36.39 kg ha^{-1}) and potassium (179.43 kg ha^{-1}) recorded from T_9 *i.e* control (no priming). The enhanced nitrogen absorption was attributable to phosphorus's favourable effect on root proliferation, anchoring, and deep penetration, which allowed the forage maize crop to collect more nutrients from the rhizosphere and transfer them to the forage maize crop, resulting in better dry matter production. Somasundaram *et al*. (2007) also reported the similar results. N uptake and green forage yield show positive correlation between them (R^2= 0.867) (Fig.1). Similar trend was reported in case of p uptake. The highest P uptake (47.29 kg ha^{-1}) was recorded from T_6 which was followed by T_7 obtaining value of 45.92 kg ha^{-1}. The lowest value (36.39 kg ha^{-1}) was obtained from T_9 (no seed priming). P uptake and forage yield showed positive correlation between them (R^2= 0.857) (Fig.1). In case of K uptake, treatment T_6 *i.e s*eed priming with KNO_3 @ 0.5% for 12 hrs. recorded highest uptake (235.30 kg ha^{-1}) and lowest value of K uptake of 179.43 kg ha^{-1} was recorded in control plot, where no seed priming was done. K uptake and green forage yield showed positive and high correlation between them (R^2= 0.818) (Fig. 1).

Production economics

Different seed priming treatments affected the production economics of forage maize which was shown in Table 3. This is because of increase in the green forage yield of maize. As regards to economics of the production, T_6 (seed priming with KNO_3 @ 0.5% for 12 hrs.) recorded the maximum net return (Rs.44,469/-) and highest B:C ratio (3.12). It was followed by T_8 *i.e* seed priming was done with KH_2PO_4 @ 0.5% for 12 hrs which recorded net return and B:C ratio of Rs. 35,534/- and 2.74, respectively.

CONCLUSION

Thus it can be concluded that seed priming with KNO_3 @ 0.5% for 12 hrs. was significantly superior over rest of the treatments with respect to germination percentage at 10 DAS, green forage yield and dry matter yield. However, same treatment also recorded significantly higher CP percentage and crude protein yield (CPY). Finally based on the results of 3 years pooled analyzed data, seed priming with KNO_3 @ 0.5% for 12 hrs. is ideal method of seed priming for enhanced germination and improved green forage yield with high crude protein % in forage maize and it was recommended for productivity enhancement of forage maize under rainfed situation.

REFERENCES

Amodu, J.T., Akpensuen, T.T., Dung, D.D., Tanko, R.J., Musa, A., Abubakar, S.A., Hassan, M.R., Jegede, J.O. and Sani, I., 2017. Evaluation of maize accessions for nutrients composition, forage and silage yields. *J. Agric. Sci.*, **6**(4): 178-187.

Banerjee, S., Jana, K., Mondal, R., Mondal, K. and Mondal, A. 2020. Effect of seed priming on growth and yield of hybrid maize-lathyrus sequence under rainfed situation. *Curr. J. Appl. Sci. Technol.,* **39**(1): 126-136.

Chaudhary, D.P., Kumar, A., Kumar, R., Singode, A., Mukri, G., Sah, R.P., Tiwana, U.S and Kumar, B. 2016. Evaluation of normal and specialty corn for fodder yield and quality traits. *Range Manage. Agroforestry*, **37**: 79-83.

Dass, S.K., Bennet, M. and Bewley, M. 2009. Counteraction of salinity stress on wheat plants by grain soaking in ascorbic acid, thiamin or sodium salicylate. *Biologia Plantarum*, **44**: 253–261

Harris, D., Rashid. A., Miraj, G., Arif. M. and Shah, H. 2011. On-farm seed priming with zinc sulphate solution, a cost-effective way to increase the maize yields of resource-poor farmers. *Field Crops Res.* **110**: 119-127.

Hassanpouraghdam, M.B., Pardaz, J.E and Akhtar, N. F. 2009. The effect of osmo-priming on germination and seedling growth of *Brassica napus* L. under salinity conditions. *J. Food, Agric. Environ.,* **7**:6

Kale, R.V. and Takawale, P.S. 2019. Seed priming techniques improve germination, forage yield, and economics of fodder maize. *Forage Res.*, **45** (3): 229-231

Khan, M.M., Iqbal, M.J. and Abbas, M. 2011. Loss of viability correlates with membrane damage in aged turnip (*Brassica rapa*) seeds. *Seed Sci. Technol.*, **33** (2):517-520

Kundu, C.K., Mondal, R., Kundu, A., Goswami, S. and Hedayetullah, Md. 2020. Studies on bio-efficacy and phytotoxicity of different formulation of 2, 4-D amine 50% SL in maize. *J. Pharmacog. Phytochem.,* **9** (5):559-562.

Schwap, Y., Roozeboom, K. L., Staggenborg, S. A. and Du, J. 2019. Dryland and irrigated corn yield with climate, management, and hybrid changes from 1939 through 2009. *Agron. J.* **104:** 473-482. doi: 10.2134/agronj2011.0242

Somasundaram, E., Amanullah, M. M., Thirukkumaran, K., Chandrasekaran, R., Vaiyapuri, K. and Sathyamoorthi, K. 2007. Biochemical changes, nitrogen flux and yield of crops due to organic sources of nutrients under maize based cropping system. *J. Appl. Sci. Res.*, 1724-1729.

Srivastava, A.K., Lokhande,V.H. Patade, V.Y. Suprasanna, P. and Souza, D. 2017. Boosting spring planted irrigated maize (*Zea mays* L.) grain yield with planting patterns adjustment. *American-Eurasian J. Agric. Environ. Sci.*, **15**: 315-319