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SEED PRIMING TECHNIQUES IMPROVE GERMINATION, FORAGE YIELD, AND ECONOMICS OF FODDER MAIZE

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SUMMARY

Poor germination and inconsistent plant population of the crop is due to the delay in sowing and reduction in the moisture content of the soil. Seed priming is the process of controlled hydration of seeds at a level that gives permission to pre-germination metabolic activity to proceed but prevents actual emergence of the radical. A study was conducted to find out the best seed priming method to enhance the fodder yield of maize African tall. Among the various treatment combinations of seed priming, significantly higher germination percentage at 88.88%, green fodder yield, dry matter yield and crude protein yield of 756.98, 159.89 and 13.32 q/ha respectively were recorded in treatment of maize African tall seed with ZnSO4 @ 0.5% for 12 hrs which was at par with seed priming with $ZnSO_4$ @ 0.5% for 6 hrs. The maximum net monetary return was obtained in seed priming treatment of with ZnSO4 @ 0.5% for 12 hrs with Rs 108225/ha followed by seed priming treatment of $ZnSO_4$@ 0.5% for 6 hrs with Rs. 105406/ha. A similar trend was observed in the benefit cost ratio.

Key words : Seed priming, Green fodder yield, Germination, Benefit-cost ratio

Seed priming is an effective technology to enhance rapid and uniform emergence and to achieve high vigor, leading to better stand establishment and yield. It is a simple and low-cost hydration technique in which seeds are partially hydrated to a point where pre-germination metabolic activities start without actual germination, and then re-dried until close to the original dry weight. Priming improves the resistance towards water and temperature stress; improve the germination percentage, uniformity of germination and speed of germination. Harris et al., (2007) reported that seed priming led to better establishment and growth, earlier flowering, increase seed tolerance to the adverse environment and greater yield in maize. Rehman *et al*., (2011) reported that seed priming is a cost-effective technology that can enhance early crop growth leading to earlier and more uniform stand with yield associated benefits in many field crops including oilseeds. The most widely used priming treatments are osmopriming and hydro-priming. In hydro-priming seeds are soaked in water overnight, surface drying and sowing farmers growing various crops have found it to be the seeds on the same day. While in osmopriming seeds simple, low-cost and low-risk technology that they could soak in osmotic solution followed by drying the seed before sowing.

Maize (*Zea mays* L.) is one of the most important cereal crops in the world and is the third important position in India after rice and wheat with an enormous role in food and nutritional security. The cobs and seeds are used as raw materials in various industries. Maize is having special significance because in addition to staple food for a human being it is also a quality feed for animal. Maize is called the miracle crop or the Queen of Cereals because it has higher yield potential as compared with other cereals (Iqbal, M.A. and M.M. Ahmad, 2015).

MATERIALS AND METHODS

The study was conducted at Central Research Station of BAIF Urulikanchan, Dist. Pune (Maharashtra), India in three successive Kharif seasons from 2016 to 2018 to identify the best seed priming method to enhance germination and improve forage yield in maize African tall. The experiment was conducted in a randomized block design with three replications having 9 different seed priming treatment combinations. The morphological observations were recorded on five randomly selected plants from each plot and from each replication and green fodder yield was recorded on a net plot basis. Dry matter and crude protein were estimated in the laboratory.

Seed priming treatment

Maize seeds were subjected to hydro-priming (distilled water only), Osmo-priming with $ZnSO_4$, KNO_3, KH_2PO_4 at 0.5% concentration for 6 hr and 12 hrs. Seed weight to solution volume ratio was 1:5 (w/v). After priming, seeds were removed from treatment solutions, re-dried near to its original weight and then sown in the field. Untreated seeds were used as a control treatment.

RESULTS AND DISCUSSION

The results of nine different priming treatments on forage yield and quality parameters were presented in Table 1. It was revealed form the table that among the different seed priming treatments, the seed treatment with $ZnSo_4$ @ 0.5% for 12 hrs was recorded highest green fodder, dry matter and crude protein yield of 756.98, 159.89 and 13.32 q/ha respectively. The second treatment of $ZnSo_4$ @ 0.5% for 6 hrs which recorded 745.40 q/ha green fodder yield, 151 q/ha dry matter yield and 12.40 q/ha crude protein yield which was at par with treatment of $ZnSo_4$ 0.5% for 12 hrs. Sadeghi *et al.* 2011 also reported increased fresh and dry weight of sorghum by primed seed to the tune of 28% as compared to a non-prime seed.

Effect of different seed priming treatments on germination and morphological character was presented in table 2. The highest germination percentage was observed in treatment seed priming with $ZnSO_4$ @0.5 % for 12 hrs with 88.88% with compares to control of 68.89%. Similar findings were reported by Hussein (2016) that, seed priming had a significant positive effect on germination. The results show hydro-priming, osmopriming with 0.5% $ZnSO_4$ and osmopriming with 2% of KH_2PO_4 caused a significant increase in seeds germination percentage compared with control in forage maize. All the osmopriming treatments show a significant difference in days to 50% flowering. Seed priming with $ZnSO_4$ @ 0.5 % for 12 hrs was recorded significantly least days to 50% flowering. In the present study, all seed priming techniques significantly increased plant height, fresh and dry weight of maize. It might be due to the early emergence of seedling and better stand establishment due to priming. Plant height was increased due to priming because it produced vigorous seedlings and provided an energetic start to seedling growth. More respiration and carbohydrate metabolism in seedlings emerged from primed seed resulted in improved plant and weight. Srivastava 2010 also reported that increased plant height of Indian mustard in plots sown contents with primed seed as compared to a non-primed seed.

Different seed priming treatments significantly affect on economics which was shown in table 3. This is because of increase in the green fodder yield of maize. Maximum net monetary return and benefit-cost ratio of Rs 108225 and 2.18 was recorded by treatment of seed priming with $ZnSO_4$ @ 0.5 % for 12 hrs followed by seed priming with $ZnSO_4$ @ 0.5 % for 6 hrs with Rs 105406 and 2.15 respectively.

CONCLUSION

Seed priming with $ZnSO_4$ @ 0.5 % for 12 hrs and $ZnSO_4$ @ 0.5 % for 6 hrs shows better germination

TABLE 1
Effect of different seed priming techniques on green fodder yield, Dry matter yield and crude protein yield of maize

Treatments	Yield (q/ha) Mean		
	Green Fodder	Dry Matter	Crude Protein
T_1–Seed priming with water for 6 hrs	612.41	121.31	9.57
T_2–Seed priming with water for 12 hrs	631.40	124.80	10.02
T_3–Seed priming with $ZnSO_4$ @ 0.5 % for 6 hrs	745.40	151.00	12.40
T_4–Seed priming with $ZnSO_4$ @ 0.5 % for 12 hrs	756.98	159.89	13.32
T_5–Seed priming with KNO_3 @ 0.5 % for 6 hrs	653.87	132.56	10.30
T_6–Seed priming with KNO_3 @ 0.5 % for 12 hrs	647.64	134.71	10.94
T_7–Seed priming with KH_2PO_4 @ 0.5 % for 6 hrs	675.86	126.97	10.00
T_8–Seed priming with KH_2PO_4 @ 0.5 % for 12 hrs	684.58	144.82	11.83
T_9–Control (no priming)	526.15	111.39	8.74
S. Em+	21.11	4.28	0.34
C. D. (P=0.05)	63.82	12.94	1.04
C. V. %	5.59	5.54	5.52

TABLE 2
Effect of different seed priming techniques on Plant height, Days to 50% flowering, Germination % and Leaf stem ratio of maize

Treatments	Physiological observations		
	Plant height (cm)	Days to 50% flowering	Germination %
T_1–Seed priming with water for 6 hrs	254.13	64.33	75.11
T_2–Seed priming with water for 12 hrs	254.41	60.67	72.22
T_3–Seed priming with $ZnSO_4$ @ 0.5 % for 6 hrs	248.66	49.33	84.66
T_4–Seed priming with $ZnSO_4$ @ 0.5 % for 12 hrs	256.50	49.33	88.88
T_5–Seed priming with KNO_3 @ 0.5 % for 6 hrs	208.70	54.33	75.44
T_6–Seed priming with KNO_3 @ 0.5 % for 12 hrs	237.59	50.67	79. 56
T_7–Seed priming with KH_2PO_4 @ 0.5 % for 6 hrs	259.92	55.67	74. 89
T_8–Seed priming with KH_2PO_4 @ 0.5 % for 12 hrs	266.24	53.00	78. 22
T_9–Control (no priming)	236.39	69.33	68. 89
S. Em+			1.67
C. D. (P=0.05)			5.06
C. V. %			3.73

TABLE 3
Effect of different seed priming techniques on economics of maize

Treatments	Gross monetary returns (Rs./ha)	Cost of cultivation (Rs./ha)	Net monetary returns (Rs./ha)	Benefit : cost ratio
T_1–Seed priming with water for 6 hrs	161443	80150	81293	2.01
T_2–Seed priming with water for 12 hrs	166394	80225	86169	2.07
T_3–Seed priming with ZnSO4 @ 0.5 % for 6 hrs	196806	91400	105406	2.15
T_4–Seed priming with ZnSO4 @ 0.5 % for 12 hrs	199700	91475	108225	2.18
T_5–Seed priming with KNO3 @ 0.5 % for 6 hrs	172338	86150	86188	2.00
T_6–Seed priming with KNO3 @ 0.5 % for 12 hrs	170572	86225	84347	1.98
T_7–Seed priming with KH2PO4 @ 0.5 % for 6 hrs	178330	87950	90380	2.03
T_8–Seed priming with KH2PO4 @ 0.5 % for 12 hrs	180270	88025	92245	2.05
T_9–Control (no priming)	138601	80000	58601	1.73
		S. Em+	4,631.19	0.05
		C. D. (P=0.05)	14,003.88	0.16
		C. V. %	9.11	9.15
Average sale price (Rs/q)	Maize 263.33			

percentage, higher plant height and least days to 50% flowering which was results in higher green fodder production, dry matter production, and crude protein production. So that these techniques help to a farmer to sustain their livestock's and generation good remunerative.

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