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Enhancement of Plant Stand Establishment through Seed Priming and Seed Treatment on Growth, Seed Yield and Quality in Foxtail Millet [*Setaria italica* (L.) Beauv.]

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A B S T R A C T

The field experiment was conducted during *kharif* 2018-19 at seed farm, College of Agriculture, Vijayapur to study the effect of seed priming and seed treatment on seed yield and quality in foxtail millet. The field experiment consisted of two factors. Factor I Seed priming Control (P_1),Hydro priming for 8hr (P_2),VIGRO-S (seaweed extract) (P_3),2 per cent $CaCl_2$(P_4),20 per cent *Pseudomonas*(P_5). Factor II seed treatment with insecticides with Thiamethoxam 25 WG @ 2g/kg (S_1),Imidacloprid 70 WG @ 5g/kg (S_2),Chlothidin 50 WG @2g/kg (S_3),Acetamiprid 20 SP @ 2g/kg (S_4) replicated three times and laid out in Factorial Randomized Block Design. The results of the investigation indicated that significantly higher field emergence (93.4, 91.3, respectively), shoot fly incidence (4.94, 4.55, respectively) recorded due to seed priming with $CaCl_2$and seed treatment. Significantly higher growth parameters such as plant height and SPAD value (92.2,26.75) at 90 DAS and dry matter (35.29) produced due to seed treatment with thiamethaxam 25 WG @ 2g/kg of seeds. The higher seed yield (19.47 q/ha), seed germination (95.75 %) was maximum with seed priming with 2 per cent $CaCl_2$ followed by hydro priming for 8 hrs with better seed quality. The seed yield and quality parameters were varied significantly with the seed treatments. The higher seed yield (18.23 q/ha), seed germination (93.53 %) was obtained with seed treatment of Thiamethaxam 25 WG @ 2g/kg of seeds followed by Imidacloprid 70 WG @ 5g/kg of seeds. The interaction effect due to seed priming and seed treatment did not varied significantly. However, the higher seed yield of 31.1 per cent (20.10 q/ha) obtained with seed priming of 2 % $CaCl_2$ along with Thiamethaxam 25 WG @ 2g/kg of seeds followed by Imidacloprid 70 WG 5g/kg of seeds.

Introduction

Foxtail millet (*Setaria italica* L.) is a versatile crop known for being genetically closely related to biofuel grasses, for its C4 photosynthesis and for its tolerance to abiotic stresses. Quality seed production is the main goal for successful agriculture, which demands each and every seed should be readily germinable and produce a vigorous

seedling ensuring high yield. "Care with the seed and joy with the harvest" and "Good seed doesn't cost it always pays" are the popular adage which enlightens the importance of the quality seed. The farmers always very much interested in the best seed management practices which are safe, environmentally sound and scientifically proven technologies. Understandably, in view of the importance of quality seeds in Agriculture, both as a product and as a means of establishing a crop, most attention at all levels of investigation has been directed to crop seeds. Seed enhancements is defined as post-harvest treatments that improve germination or seedling growth, or facilitate the delivery of seeds and other materials required at the time of sowing. Seed enhancement is a range of treatments of seeds that improves their performance after harvesting and conditioned, but before they are sown. Seed enhancement include priming, hardening, pre germination, pelleting, encrusting, film coating etc, but excludes treatments for control of seed borne pathogens (Black *et al.,* 2006).

Millets require very little water for their cultivation just around 25–30% of the annual rainfall required by crops such as rice and sugarcane. Thus, millets do not require irrigation and power for their production. In addition, millets also not require any synthetic fertilizers and are completely pest-free crop as none of the millets attracts any pests. Thus, the production of millets is very economical for farmers because of almost nil expenditure on irrigation, fertilizers, and pesticides. Importantly, seeds of most millets can be stored for longer period and are not affected by storage pests. Nutritionally, millets are several times superior to other cereal crops such as rice and wheat (Lata *et al.,* 2013). "On-farm seed priming involving soaking of seeds in water that can be enhancing the crop establishment throughout life cycle (Harris, 2010).Hydro priming has been used as a technique of seed priming in the current research. Hydro priming is achieved by adding a restricted amount of water to the seeds continuously or successively. It is a very significant method that results in fast germination and consistency in different plants (Adebisi *et al.,* 2013). Seed germination and seedling development through the hydro priming method have been revealed to be enhanced. Hydro priming enhanced barley and chickpea results in the field (Rashid *et al.,* 2006). Because easy water is used, it is a very easy, economical and environmentally friendly method. Seed priming with PGPR results in higher germination and improves the initial crop establishment of seedlings. It initiates the germination physiological process but prevents plumule and radicle from emerging. Physiological process helps to establish and proliferate PGPRs on the spermphere (Sridevi *et al.,* 2016). Organic seed priming with bacterial antagonists increases the antagonist population load to a maximum of 10 times on the plants, thus protecting the insect pest.

Materials and Methods

The field experiment was conducted during *kharif* 2018-19 at seed farm, College of Agriculture, Vijayapur to study the effect of seed priming and seed treatment on seed yield and quality in foxtail millet and it is located at a latitude of 16^0 55^1 North, longitude of 75^0 58^1 East and an altitude of 593 meters above mean sea level. The experimental site comes under the Northern Dry Zone of Karnataka (Zone 3).The field experiment consisted of two factors. Factor I Seed priming Control (P_1),Hydro priming for 8hr (P_2),VIGRO-S (sea weed extract), (P_3) 2 per cent $CaCl_2$(P_4),20 per cent *Pseudomonas*(P_5). While Factor II seed treatment with with Thiamethoxam 25 WG @ 2g/kg (S_1), Imidacloprid 70 WG @ 5g/kg (S_2),Chlothidin 50 WG @2g/kg (S_3),Acetamiprid 20 SP @ 2g/kg (S_4) with

three replications laid out in Factorial Randomized Block Design. Seed sown with a Spacing 30 cm × 10 cm and the cultivar DHFT-333 was used. The data collected from the experiment on different aspects was subjected to statistical analysis as described for Factorial Randomized Block Design given by Gomez and Gomez (1984). The level of significance used in F test was 0.05. A critical difference value was calculated wherever the 'F' tests found to be significant. The seedling vigour index was computed by adopting the method suggested by Abdul-Baki and Anderson (1973) and expressed as an index numbers.

SVI = [Root length (cm) + Shoot length (cm)] × Germination (per cent)

Results and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under the following heads.

Field emergence and shoot fly incidence

Field emergence differed significantly due to seed priming with $CaCl_2$ and recorded significantly higher field emergence (93.4 %) and reduced shoot fly incidence (4.94 %) followed by hydro priming for 8 hrs. While lower field emergence and higher shoot fly incidence was recorded in control. Seed treatment of thiomethaxam 25 WG @ 2g/kg of seeds significantly improved higher field emergence (91.30 %) and shoot fly incidence (4.55 %) followed by seed treatment of imidacloprid @ 5 g/kg of seeds. While the lower field emergence and shoot fly incidence was seen in acetamiprid 20 SP @ 2 g/kg of seeds. Interaction effect did not varied significantly due to seed priming and seed treatment. However, seed priming with 2 per cent $CaCl_2$ along with seed treatment of thiomethaxam 25 WG @ 2g/kg of seeds recorded higher field emergence (96 %) and reduced shoot fly incidence (1.87 %) followed by seed priming with 2 per cent $CaCl_2$ along with seed treatment of imidacloprid @ 5g/kg of seeds while the lowest field emergence and shoot fly incidence was seen in no priming but seed treated with acetamiprid 20 SP @ 2g/kg of seeds. The field emergence of foxtail millet was influenced significantly due to seed priming treatments. The maximum field emergence was showed in seed priming with 2 per cent $CaCl_2$. This might be due to seed priming being one of the most significant innovations to assist speedy and uniform germination, reducing the time of germination and enhancing the uniformity of development so that seeds are efficient in promoting the seedling establishment's quicker development. Similar results obtained by Venkatesh *et al.*, (2018). The shoot fly incidence of foxtail millet was significantly influenced by seed treatment. The lowest shoot fly percent incidence (4.55 %) was seen in seed treatment with thiomethaxam 25 WG @ 2g/kg of seeds, followed imidacloprid 70 WG 5g/kg of seeds (6.32 %), chlothidian 50 WG @ 2g/kg of seeds (7.90 %). Whereas the maximum shoot fly incidence (10.38 %) was noticed in acetamiprid 20 % SP @ 2g/kg of seeds.In earlier reports also improved germination and better seedlings growth was observed with imidacloprid and thiamethoxam seed treatment in sorghum and maize due to phyto-tonic effects (Jindal and Hari, 2008).Similar result were also obtained by Bhupender singh *et al.*, (2017).

Growth parameters

Growth parameters differed significantly due to seed priming with $CaCl_2$ recorded significantly higher plant height and SPAD value at 90 DAS (93.1 cm) and (26.83) respectively, and plant dry matter (37.22 g) followed by hydro priming for 8 hrs. While

lower growth parameters was recorded in control. Seed treatment of thiomethaxam 25 WG @ 2g/kg of seeds significantly improved higher growth parameters higher plant height and SPAD value at 90 DAS (92.2 cm) and (26.75) respectively and plant dry matter (35.29 g)followed by seed treatment of imidacloprid @ 5 g/kg of seeds. While the lower growth parameters was recorded in acetamiprid 20 SP @ 2 g/kg of seeds. Interaction effect did not varied significantly due to seed priming and seed treatment. However, seed priming with 2 per cent $CaCl_2$ along with seed treatment of thiomethaxam 25 WG @ 2g/kg of seeds recorded higher growth parameters plant height and SPAD value at 90 DAS (96.5 cm) and (31.31) respectively and plant dry matter (40.77 g) followed by seed priming with 2 per cent $CaCl_2$ along with seed treatment of imidacloprid @ 5g/kg of seeds while the lowest growth parameters was seen in no priming but seed treated with acetamiprid 20 SP @ 2g/kg of seeds. Seed priming improve the crop growth parameters due to the redistribution of nutrient resources that lead to cell enlargement and increased ordinary cell division, increases the efficiency of water level even under stress condition during vegetative growth of the plant. Effective role in improving morpho-physiological characters and easy approach to enhance the seed performance. Similar results obtained by Prajapati *et al.,* (2017).

Yield parameters

Yield parameters differed significantly due to seed priming with $CaCl_2$ recorded significantly higher panicle length (16.10 cm), panicle diameter (1.41 cm), seed yield (19.47 q/ha), Stover yield (4.23 t/ha) and test weight (3.56 g) followed by hydro priming for 8 hrs. While lower yield parameters was recorded in control. Seed treatment of thiomethaxam 25 WG @ 2g/kg of seeds significantly improved higher panicle length (15.40 cm), panicle diameter (1.34 cm), seed yield (18.23 q/ha), stover yield, (4.06 t/ha) and test weight (3.34 g) followed by seed treatment of imidacloprid @ 5 g/kg of seeds. While the lower yield parameters was recorded in acetamiprid 20 SP @ 2 g/kg of seeds. Interaction effect did not varied significantly due to seed priming and seed treatment. However, seed priming with 2 per cent $CaCl_2$ along with seed treatment of thiomethaxam 25 WG @ 2g/kg of seeds recorded higher panicle length (17.53 cm), panicle diameter (1.57 cm), seed yield (20.10 q/ha), stover yield, (4.70 t/ha) and test weight (3.82 g) followed by seed priming with 2 per cent $CaCl_2$ along with seed treatment of imidacloprid @ 5g/kg of seeds while the lowest yield parameters was seen in no priming but seed treated with acetamiprid 20 SP @ 2g/kg of seeds. The higher seed yield of 22.37 per cent over control recorded due to seed priming with $CaCl_2$.The increased seed yield mainly attributed higher dry matter at 60 DAS, test weight, seed yield and Stover yield (37.22 g, 3.56 g, 19.47 q/ha, 4.23t/ha respectively) as compared to control followed by hydro priming for 8 hrs, seed priming with *pseudomonas florescence* 20. While the lowest Dry matter at 60 DAS, test weight, seed yield and Stover yield recorded in control (30.04 g, 2.83 g, 15.91 q/ha, 3.04 t/ha respectively). Due to increases all the yield attributing characters and high partitioning of the plant assimilates towards the sink so increases the yield parameters. Similar results obtained by Prajapati *et al.,* (2017) and Kunal *et al.,* (2012).The higher seed yield of 7.17 per cent over control. Recorded due to seed treatment with thiomethaxam 25 WG @ 2g/kg of seeds. The increased seed yield mainly attributed higher dry matter at 60 DAS, test weight, seed yield and Stover yield (35.29 g, 3.34 g, 18.23 q/ha, 4.06t/ha respectively) as compared to control, followed by imidacloprid 70 WG 5g/kg of seeds. While the lowest Dry matter at 60 DAS, test weight, seed yield and Stover yield recorded in Acetamiprid 20 SP (31.56 g,

3.01 g, 17.01 q/ha, 3.29 t/ha respectively). Due to seed treatment with insecticides were did not affect the toxic to the plants and increases all the yield attributing characters and high partitioning of the plant assimilates towards the sink so increases the yield parameters. Similar results obtained by Kumar and Prabhuraj (2007).The Dry matter at 60 DAS, test weight, seed yield and Stover yield was not significantly influenced by the seed priming and seed treatments. The higher seed yield of 31.11 percent over control. The increased seed yield mainly attributed higher Dry matter at 60 DAS, test weight, seed yield and Stover yield (40.77g, 3.82 g, 20.10 q/ha, 4.70t/ha) respectively was recorded in seed priming with 2 per cent $CaCl_2$ along with seed treatment of thiomethaxam 25 WG @ 2g/kg of seeds followed by seed priming 2 per cent $CaCl_2$ along with seed treatment of imidacloprid 70 @ 5g/kg of seeds. While the minimum seed yield was noticed in control no primed seed with acetamiprid 20 SP @ 2g/kg of seeds (29.00 g, 2.73 g, 15.33 q/ha, 2.63 t/ha). Due to high partitioning of the plant assimilates towards the sink so increases the yield parameters.

Seed quality parameters

Seed quality parameters differed significantly due to seed priming with $CaCl_2$ recorded significantly higher seed germination (95.75 %), root length (2.12 cm), shoot length (8.94 cm), seedling length (11.06 cm), seedling dry weight (30.38 mg), SVI (852) electrical conductivity (0.35dSm^{-1}), seed protein (11.16 %), total sugar (5.55 %), non reducing sugar (3.71 %) and reducing sugar(1.85 %)followed by hydro priming for 8 hrs. While lower quality parameters was recorded in control. Seed treatment of thiomethaxam 25 WG @ 2g/kg of seeds significantly improved higher Seed quality parameters viz., seed germination (93.53 %), root length (1.87 cm), shoot length (8.33 cm), seedling length (10.20 cm), seedling dry weight (30.15 mg), SVI (782), electrical conductivity (0.37 dSm-1), followed by seed treatment of imidacloprid @ 5 g/kg of seeds. While the lower quality parameters was recorded in acetamiprid 20 SP @ 2 g/kg of seeds. Interaction effect did not varied significantly due to seed priming and seed treatment. However, seed priming with 2 per cent $CaCl_2$ along with seed treatment of thiomethaxam 25 WG @ 2g/kg of seeds recorded higher Seed quality parameters viz., seed germination (97.00 %), root length (2.41 cm), shoot length (9.48 cm), seedling length (11.89 cm), seedling dry weight (31.33 mg), SVI (921) electrical conductivity (0.32 dSm^{-1}), followed by seed priming with 2 per cent $CaCl_2$ along with seed treatment of imidacloprid @ 5g/kg of seeds while the lowest yield parameters was seen in no priming but seed treated with acetamiprid 20 SP @ 2g/kg of seeds. Seed quality parameters were influenced significantly due to the seed priming treatments. The significantly higher seed germination of 9.81 per cent over control due to seed priming with 2 per cent $CaCl_2$. The increased seed germination mainly attributed to higher shoot length, root length, seedling length, seedling dry weight, vigour index and lower electrical conductivity were recorded in seed priming with 2 per cent $CaCl_2$.(2.12 cm, 8.94 cm, 11.06 cm, 30.38 mg, 852, 0.35 dSm-1 respectively) followed by hydro priming for 8 hrs, seed priming with *pseudomonas florescence* 20 %. While the lower seed quality parameters was recorded in control (1.28 cm, 6.97 cm, 27.42 mg, 8.24 cm, 621, 0.47 dSm-1 respectively). Due to seed priming increases the better performance of the seed, higher test weight of the seeds and other food reserves in the endosperm of the seeds so ultimately higher seed quality. Similar results obtained by (Prabhu *et al.*, 2015), (Venkatesh 2018).Seed quality parameters were influenced significantly due to the seed treatments. The significantly higher seed quality parameters.

Table.1 Effect of seed priming and seed treatment with insecticides on field emergence and shoot fly in foxtail millet

Priming	Field emergence (%)					Shoot fly (%)				
	Seed treatment					Seed treatment				
	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
P_1	84.3	83.3	81.0	79.7	82.1	7.13(15.43)*	8.37(16.78)	9.87(18.26)	12.40 (20.58)	9.44 (17.76)
P_2	93.3	92.0	91.0	89.7	91.5	2.40(8.88)	4.77(12.60)	6.77(15.04)	9.13(17.59)	5.77(13.53)
P_3	90.7	88.7	87.3	83.0	87.4	6.37(14.59)	7.80(16.20)	9.07(17.51)	11.73(20.02)	8.74 (17.08)
P_4	96.0	94.0	92.3	91.3	93.4	1.87(7.84)	3.97(11.49)	5.90(14.04)	8.03(16.46)	4.94(12.46)
P_5	92.3	91.3	89.3	88.0	90.3	4.97(12.87)	6.70(15.00)	7.90(16.32)	10.60(19.00)	7.54 (15.80)
Mean	91.3	89.9	88.2	86.3		4.55(11.92)	6.32(14.41)	7.90(16.24)	10.38(18.73)	
For comparing the means of	S.Em±	CD at 5 %	CV			S.Em±	CD at 5 %	CV		
P	2.6	7.4	10.1			0.28	0.82	12.71		
S	2.3	6.6				0.25	0.73			
P X S	5.2	NS				0.57	NS			

Note:
NS- Non significant
*Figures in parenthesis indicate Arc sine transformed values

Priming
P_1 – Control
P_2 – Hydro priming for 8hr
P_3 – Seed priming with VIGRO-S (sea weed extract)
P_4 – Priming with 2 per cent $CaCl_2$
P_5 – Seed priming with 20 per cent *Pseudomonas*

Seed treatment
S_1 –Seed treatment with thiamethoxam 25 WG @ 2g/kg
S_2 - Seed treatment with Imidacloprid 70 WG @ 5g/kg
S_3 - Seed treatment with chlothidin 50 WG @2g/kg
S_4 - Seed treatment with Acetamiprid 20 SP @ 2g/kg

Table.2 Effect of seed priming and seed treatment with insecticides on plant height in foxtail millet

Priming	Plant height (cm) at 30 DAS					Plant height (cm) at 60 DAS					Plant height (cm) at 90 DAS				
	Seed treatment					Seed treatment					Seed treatment				
	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
P_1	32.1	29.2	27.9	26.7	29.0	73.5	71.2	65.7	59.8	67.6	88.1	86.3	73.0	60.0	76.9
P_2	36.3	35.5	33.5	31.8	34.3	81.3	79.7	76.9	75.3	78.3	94.0	93.0	92.1	86.1	91.3
P_3	31.0	30.7	30.1	32.1	31.0	75.3	72.8	71.2	62.7	70.5	90.1	89.0	88.4	72.4	85.0
P_4	38.2	36.7	34.8	33.3	35.8	84.6	81.7	79.5	78.2	81.0	96.5	95.0	92.4	88.4	93.1
P_5	33.8	32.7	31.4	30.3	32.1	78.3	75.5	73.5	73.0	75.1	92.1	91.4	90.3	74.8	87.2
Mean	34.3	33.0	31.3	31.1		78.6	76.2	73.4	69.8		92.2	90.9	87.3	76.4	
For comparing the means of	S.Em±	CD at 5 %	CV			S.Em±	CD at 5 %	CV			S.Em±	CD at 5 %	CV		
P	1.0	2.8	10.5			2.3	6.6	10.7			3.4	9.7	13.6		
S	0.9	2.5				2.0	5.9				3.0	8.7			
P X S	2.0	NS				4.6	NS				6.8	NS			

Note:
NS- Non significant DAS – Days after sowing

Priming
P_1 – Control
P_2 – Hydro priming for 8hr
P_3 – Seed priming with VIGRO-S (sea weed extract)
P_4 – Priming with 2 per cent $CaCl_2$
P_5 – Seed priming with 20 per cent *Pseudomonas*

Seed treatment
S_1 –Seed treatment with thiamethoxam 25 WG @ 2g/kg
S_2 - Seed treatment with Imidacloprid 70 WG @ 5g/kg
S_3 - Seed treatment with chlothidin 50 WG @2g/kg
S_4 - Seed treatment with Acetamiprid 20 SP @ 2g/kg

Table.3 Effect of seed priming and seed treatment with insecticides on SPAD value at 30, 60 and 90 DAS in foxtail millet

Priming	SPAD at 30 DAS					SPAD at 60 DAS					SPAD at 90 DAS				
	Seed treatment					Seed treatment					Seed treatment				
	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
P_1	31.40	30.60	29.53	28.43	29.99	35.30	33.07	31.30	29.20	32.22	23.43	21.80	20.70	18.77	21.18
P_2	37.17	35.53	33.67	32.10	34.62	41.43	38.57	35.63	33.50	37.28	27.53	25.83	24.27	21.57	24.80
P_3	32.90	31.80	30.40	29.97	31.27	36.37	35.10	32.33	29.95	33.44	24.63	23.37	21.70	19.33	22.26
P_4	41.25	37.97	35.43	33.43	37.02	42.47	41.57	38.29	35.90	39.71	31.31	27.87	25.31	22.83	26.83
P_5	34.90	33.40	31.67	30.90	32.72	36.70	36.47	33.80	31.60	34.64	26.83	24.40	23.00	22.03	24.07
Mean	35.52	33.86	32.14	30.97		38.45	36.95	34.39	32.03		26.75	24.65	23.00	20.91	
For comparing the means of	S.Em ±	CD at 5 %	CV			S.Em ±	CD at 5 %	CV			S.Em ±	CD at 5 %	CV		
P	1.03	2.96	10.81			1.81	5.17	17.60			0.76	2.19	11.11		
S	0.92	2.65				1.62	4.63				0.68	1.96			
P X S	2.07	NS				3.61	NS				1.53	NS			

Note:

NS – non significant DAS – Days after sowing

Priming

P_1 – Control
P_2 – Hydro priming for 8hr
P_3 – Seed priming with VIGRO-S (sea weed extract)
P_4 – Priming with 2 per cent $CaCl_2$
P_5 – Seed priming with 20 per cent *Pseudomonas*

Seed treatment

S_1 –Seed treatment with thiamethoxam 25 WG @ 2g/kg
S_2 - Seed treatment with Imidacloprid 70 WG @ 5g/kg
S_3 - Seed treatment with chlothidin 50 WG @2g/kg
S_4 - Seed treatment with Acetamiprid 20 SP @ 2g/kg

Table.4 Effect of seed priming and seed treatment with insecticides on yield parameters in foxtail millet

Priming	Plant dry matter (g)					Panicle length (cm)					Panicle diameter (cm)				
	Seed treatment					Seed treatment					Seed treatment				
	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
P_1	30.70	30.77	29.70	29.00	30.04	13.23	12.97	12.53	12.07	12.70	1.07	1.00	0.93	0.83	0.96
P_2	37.97	36.10	34.90	33.17	35.53	16.85	16.17	14.62	14.17	15.45	1.48	1.33	1.29	1.18	1.32
P_3	32.13	32.00	31.83	30.13	31.53	14.20	13.90	13.10	12.90	13.53	1.23	1.10	1.03	0.93	1.08
P_4	40.77	38.77	35.17	34.17	37.22	17.53	16.67	15.39	14.80	16.10	1.57	1.50	1.36	1.21	1.41
P_5	34.87	33.77	33.63	31.33	33.40	15.17	14.63	13.60	13.27	14.17	1.35	1.26	1.19	1.11	1.23
Mean	35.29	34.28	33.05	31.56		15.40	14.87	13.85	13.44		1.34	1.24	1.16	1.05	
For comparing the means of	S.Em±	CD at 5 %	CV			S.Em±	CD at 5 %	CV			S.Em±	CD at 5 %	CV		
P	1.03	2.95	10.63			0.45	1.29	10.86			0.04	0.10	10.45		
S	0.92	2.64				0.40	1.16				0.03	0.09			
P X S	2.06	NS				0.90	NS				0.07	NS			

Note:
NS- Non significant

Priming
P_1 – Control
P_2 – Hydro priming for 8hr
P_3 – Seed priming with VIGRO-S (sea weed extract)
P_4 – Priming with 2 per cent $CaCl_2$
P_5 – Seed priming with 20 per cent *Pseudomonas*

Seed treatment
S_1 –Seed treatment with thiamethoxam 25 WG @ 2g/kg
S_2 - Seed treatment with Imidacloprid 70 WG @ 5g/kg
S_3 - Seed treatment with chlothidin 50 WG @2g/kg
S_4 - Seed treatment with Acetamiprid 20 SP @ 2g/kg

Table.5 Effect of seed priming and seed treatment with insecticides on yield parameters in foxtail millet

Priming	Seed yield (q/ha)					Stover yield (t/ha)				
	Seed treatment					Seed treatment				
	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
P_1	16.47	16.07	15.77	15.33	15.91	3.43	3.17	2.93	2.63	3.04
P_2	19.10	18.73	18.47	18.00	18.58	4.33	3.97	3.76	3.53	3.90
P_3	17.33	16.93	16.47	16.13	16.72	3.80	3.47	3.36	3.13	3.44
P_4	20.10	19.67	19.27	18.83	19.47	4.70	4.47	3.93	3.83	4.23
P_5	18.13	17.60	17.27	16.73	17.43	4.03	3.70	3.59	3.30	3.66
Mean	18.23	17.80	17.45	17.01		4.06	3.75	3.52	3.29	
For comparing the means of	S.Em±	CD at 5 %	CV			S.Em±	CD at 5 %	CV		
P	0.34	0.96	11.50			0.11	0.32	10.73		
S	0.30	0.86				0.10	0.29			
P X S	0.67	NS				0.23	NS			

Note:
NS- Non significant

Priming
P_1 – Control
P_2 – Hydro priming for 8hr
P_3 – Seed priming with VIGRO-S (sea weed extract)
P_4 – Priming with 2 per cent $CaCl_2$
P_5 – Seed priming with 20 per cent *Pseudomonas*

Seed treatment
S_1 –Seed treatment with thiamethoxam 25 WG @ 2g/kg
S_2 - Seed treatment with Imidacloprid 70 WG @ 5g/kg
S_3 - Seed treatment with chlothidin 50 WG @2g/kg
S_4 - Seed treatment with Acetamiprid 20 SP @ 2g/kg

Table.6 Effect of seed priming and seed treatment with insecticides on test weight, seed germination, in foxtail millet

Priming	Test weight (g)					Seed germination (%)				
	Seed treatment					Seed treatment				
	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
P_1	2.97	2.83	2.77	2.73	2.83	90.00	89.00	88.67	88.33	89.00
P_2	3.60	3.37	3.10	3.17	3.31	96.00	95.67	94.00	93.33	94.58
P_3	3.03	2.93	2.87	2.83	2.92	91.33	90.67	90.00	89.67	90.42
P_4	3.82	3.63	3.45	3.33	3.56	97.00	96.30	94.33	94.67	95.75
P_5	3.27	3.10	2.90	3.00	3.07	93.00	92.67	91.67	90.33	91.92
Mean	3.34	3.17	3.02	3.01		93.53	92.60	91.93	91.27	
For comparing the means of	S.Em±	CD at 5 %	CV			S.Em±	C.D. at 1 %			
P	0.09	0.27	10.45			0.46	1.31			
S	0.08	0.24				0.41	1.18			
P X S	0.19	NS				0.92	NS			

Note:
NS- non significant

Priming
P_1 – Control
P_2 – Hydro priming for 8hr
P_3 – Seed priming with VIGRO-S (sea weed extract)
P_4 – Priming with 2 per cent $CaCl_2$
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Seed treatment
S_1 –Seed treatment with thiamethoxam 25 WG @ 2g/kg
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S_3 - Seed treatment with chlothidin 50 WG @2g/kg
S_4 - Seed treatment with Acetamiprid 20 SP @ 2g/kg

Table.7 Effect of seed priming and seed treatment with insecticides on seed quality parameters in foxtail millet

Priming	Seedling length (cm)					Seedling dry weight (g)					SVI					Electrical conductivity (dSm^{-1})				
	Seed treatment					Seed treatment					Seed treatment					Seed treatment				
	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
P_1	8.93	8.40	7.93	7.70	8.24	28.77	27.63	26.90	26.37	27.42	676	630	597	581	621	0.43	0.45	0.50	0.52	0.47
P_2	10.83	10.37	9.79	9.31	10.08	30.22	30.13	30.03	29.61	30.26	846	817	756	714	783	0.36	0.37	0.37	0.38	0.37
P_3	9.41	8.85	8.40	8.07	8.68	29.50	28.43	28.10	27.57	28.40	714	659	631	607	653	0.41	0.44	0.48	0.50	0.46
P_4	11.89	11.39	10.72	10.24	11.06	31.33	30.40	30.23	29.53	30.38	921	883	813	793	852	0.32	0.34	0.33	0.38	0.35
P_5	9.93	9.32	8.73	8.50	9.12	30.17	29.97	28.17	27.90	29.05	755	699	654	626	684	0.37	0.38	0.39	0.41	0.39
Mean	10.20	9.67	9.12	8.76		30.15	29.35	28.70	28.20		782	738	690	664		0.37	0.39	0.42	0.44	
For comparing the means of	S.Em±	C.D. at 1 %				S.Em ±	C.D. at 1 %					S.Em ±	C.D. at 1 %			S.Em±	C.D. at 1 %			
P	0.20	0.58				0.24	0.68					18.81	53.96			0.01	0.02			
S	0.18	0.52				0.21	0.61					16.82	48.26			0.02	0.04			
P X S	0.40	NS				0.47	NS					37.62	NS			0.03	NS			

Note:
NS- Non significant

Priming
P_1 – Control
P_2 – Hydro priming for 8hr
P_3 – Seed priming with VIGRO-S (sea weed extract)
P_4 – Priming with 2 per cent $CaCl_2$
P_5 – Seed priming with 20 per cent *Pseudomonas*

Seed treatment
S_1 –Seed treatment with thiamethoxam 25 WG @ 2g/kg
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S_3 - Seed treatment with chlothidin 50 WG @2g/kg
S_4 - Seed treatment with Acetamiprid 20 SP @ 2g/kg

The higher seed germination of 2.47 per cent over control due to seed treatment with thiomethaxam 25 WG @ 2g/kg of seeds. The increased seed germination mainly attributed to maximum shoot length, root length, seedling length, seedling dry weight, vigour index and minimum electrical conductivity were recorded in seed treatment with thiomethaxam 25 WG @ 2g/kg of seeds. (1.87 cm, 8.33 cm, 10.20 cm, 30.15 mg, 782, 0.37 dSm^{-1} respectively) followed by imidacloprid 70 WG 5g/kg of seeds. While the lower seed quality parameters was recorded in Acetamiprid 20 SP (1.51 cm, 7.25 cm, 28.20 mg, 8.76 cm, 664, 0.44 dSm^{-1} respectively). Due to seed treatment with insecticides were did not affect the cumulative germination rate and suppressing root system development in the cotyledon stage Similar results obtained by Balikai *et al.*,(2010). Seed quality parameters were not differed significantly due to the seed priming and seed treatments. The higher seed quality parameters. The higher seed germination of 9.85 per cent over control due to seed priming with 2 per cent $CaCl_2$ along with seed treatment of thiomethaxam 25 WG @ 2g/kg of seeds. The increased seed germination mainly attributed to higher shoot length, root length, seedling length, seedling dry weight, vigour index and lower electrical conductivity were recorded in seed priming with 2 per cent $CaCl_2$ along with seed treatment of thiomethaxam 25 WG @ 2g/kg of seeds (97 %, 2.41 cm, 9.48 cm, 11.89 cm, 31.33 mg, 921 and 0.32 dSm^{-1}) followed by seed priming 2 per cent $CaCl_2$ along with seed treatment of imidacloprid 70 @ 5g/kg of seeds. While the lower seed quality parameters was recorded in control no primed seed with acetamiprid 20 SP @ 2g/kg of seeds (88.33 %, 1.13 cm, 6.57 cm, 7.70 cm, 581, 26.37 mg and 0.52 dSm^{-1}). This might be due to seed priming increases the better performance of the seed and other food reserves in the endosperm of the seeds so ultimately higher seed quality. The shoot fly percent incidence of foxtail millet was not differed significantly due to the interaction of seed priming and seed treatment. The lower shoot fly incidence (1.87 %) was recorded in seed priming with 2 per cent CaCl2 along with seed treatment of thiomethaxam 25 WG @ 2g/kg of seeds. Followed by hydro priming for 8 hours along with thioamethaxam 25 WG @ 2g/kg of seeds (2.40 %), seed priming 2 per cent $CaCl_2$ along with seed treatment of imidacloprid 70 @ 5g/kg of seeds (3.97 %). Whereas the maximum shoot fly incidence (10.60 %) was recorded in no primed seed with acetamiprid 20 SP @ 2g/kg of seeds.

Finally seed priming with 2 per cent $CaCl_2$ coupled with seed treatment of thiomethaxam 25 WG @ 2g/kg of seeds produced higher growth, seed yield with better quality, enhanced plant stand establishment, lower shoot fly incidence and reduces the time of germination.

References

Adebisi, M. A., Kehinde, T. O., Abdul-Rafiu, M. A., Esuruoso, O. A., Oni, O. D. and Ativie, O., 2013, Seed physiological quality of three capsicum species as affected by seed density and hydropriming treatment durations. *J. Agron.*, 12: 38-45.

Abdul-Baki, A. S. and Anderson, J. D., 1973, Vigour determination in soybean by multiple criteria. *Crop Sci*., 13: 630-633.

Balikai, R. A. and Bhagwat, V. R., 2010, Evaluation of integrated pest management components for the management of shoot fly, shoot bug and aphid in *rabi* sorghum. *Karnataka J. Agric. Sci*., 22(3).

Black Michael H, Peter H. The encyclopedia of seeds: science, technology and uses. Wallingford, UK: CABI, 2006, 224

Bhupender singh, Narender kumar and Harish

kumar, 2017, Seasonal incidence and management of sorghum shoot fly, *Atherigona soccata* rondani. *Forage Res*., 42(4): 218-224.

Harris, D., 2010, Increasing yields of rain fed crops in Africa using on-farm seed priming. African *Crop Science Conf. Proc*., 6: 26-30.

Jindal J, Hari NS. Efficacy of seed treatments and foliar sprays against shoot fly *Atherigona naqvii* Steyskal on spring-sown maize. Journal of Insect Science. 2008; 21:249-252.

Kumar, L. V. and Prabhuraj, A., 2007, Bio-efficacy of chemicals for seed treatment against sorghum shoot fly, *Atherigona soccata* and shoot bug, *Peregrinus maidis*. *Ann. Pl. Prot. Sci*., 15(2): 312-315.

Kunal, V., Jadhav, Kayande, N. V. and Wandhare, M. R., 2012, Effect of seed priming on yield and yield components of soybean *Int. J. Plant Sci*., 6(4): 587-595,

Lata C, Gupta S, Prasad M (2013) Foxtail millet: a model crop for genetic and genomic studies in bioenergy grasses. Crit Rev Biotechnol 33:328–343

Prabhu, T. and Kumar, P. S., 2018, Seed hardening with organics and inorganics on seedling, growth and yield characters in rice cv. ADT 37. *Plant Arch.*, 18(1): 693-696.

Prajapati, K. R., Patel, D. B., Patil, K. and Bhadane, R. S., 2017, Effect of seed hardening on morpho-physiological and yield parameters in black gram (*Vigna mungo* L.). *Int. J. Chem. Stud*., 5(4): 439-441.

Rahman, I.U., Ali, N., Rab, A. and Shah, Z., 2013, Role of pre storage seed priming in controlling seed deterioration during storage. *Sarhad J. Agric*., 29: 379-386.

Rashid, A., Hallington, P. A, Harris, D. and Khan, P., 2006, On-farm seed priming for barley on normal, saline, saline-sodic soils in Northwest Frontier Province, Pakistan. *European J. Agron*., 24: 276-281.

Sridevi, R. and Manonmani, V., 2016, Seed priming effect on physiological traits of kodo millet and barnyard millet. *Int. J. Agric. Sci. Res.*, 6(2): 759-772.

Venkatesh Babu, S. D., Balaji Nayak and Sujathamma, P., 2018, Studies on seed priming on seedling vigour, crop growth and yield of groundnut (Arachis hypogaea l.) under rainfedconditons. *Int. J. Pure App. Biosci.*, 6(5): 238-242.

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