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EFFECT OF SEED COATING AND PELLETING ON SEED, SEEDLING AND MORPHOLOGICAL CHARACTERS OF SESAMUM (*SESAMUM INDICUM* L.)

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ABSTRACT

The present field investigation entitled "Effect of Seed Coating and Pelleting on Seed, Seedling and Morphological Characters of Sesamum (*Sesamum indicum* L.)" was carried out at the Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during Kharif 2023 and Summer 2024. The experiment was conducted using the sesame variety GT-4 under a Randomized Block Design (RBD) with forty treatments and four replications to study the influence of various coating and pelleting materials on growth, yield attributes, and yield performance of sesame under field conditions. The treatments comprised different combinations of seed coating and pelleting materials including three priming agents (Water, Bijamrut, and Potassium nitrate), two binders (Acacia gum and Rice gruel), and several filler materials (Gypsum, Fly ash, Neem leaf powder, Custard apple leaf powder, Turmeric powder, and Wheat gruel). The treatments were systematically coded as T1 to T40. The primary objective of the study was to identify the most effective combination for improving field emergence, growth, and yield parameters of sesame. The results clearly indicated that seed coating and pelleting treatments significantly influenced field emergence, growth, and yield attributes during both seasons. Among all the treatments, T28 (Potassium nitrate + Rice gruel + Fly ash) recorded the best overall performance. This treatment showed the highest field emergence (89.76%), initial plant population (98.92), plant height (130.24 cm), number of primary branches per plant (3.98), number of capsules per plant (73.67), number of seeds per capsule (56.76), plant population at maturity (99.70), and seed yield per plant (11.90 g), with early maturity (66.33 days). The superior performance of this treatment can be attributed to the synergistic effect of potassium nitrate, which enhances metabolic activity and seedling vigor; rice gruel, which provides organic nutrients and improves adhesion; and fly ash, which enhances aeration and root establishment. In contrast, the lowest performance was observed in T1 (Water priming + Acacia gum + No filler material), which recorded minimum field emergence (52.69%), initial plant population (60.76), plant height (67.50 cm), primary branches (1.82), capsules per plant (33.88), delayed maturity (102.06 days), and lowest seed yield per plant (3.67 g). The poor performance of this treatment could be due to the absence of nutrient- or stimulant-based priming and filler components, leading to weak seedling establishment and lower yield potential. The comparative analysis of Kharif and Summer seasons revealed that summer-grown sesame showed overall higher performance in growth and yield parameters, suggesting favorable environmental conditions for the expression of treatment effects during this season. Treatments involving potassium nitrate consistently outperformed those with water or Bijamrut, highlighting its critical role in enhancing physiological processes such as enzyme activation, osmotic regulation, and nutrient uptake. Overall, the findings demonstrated that seed coating and pelleting significantly enhanced the morphological and yield characteristics of sesame under field conditions. The treatment Potassium nitrate + Rice gruel + Fly ash (T28) proved to be the most effective combination, followed by Potassium nitrate + Acacia gum + Fly ash (T23). These treatments improved field emergence, plant growth, and final seed yield, indicating that integrating nutrient-based priming and organic binder materials can be an effective and eco-friendly approach for improving sesame productivity. Hence, potassium nitrate-based coating and pelleting formulations can be recommended for sesame seed enhancement under field conditions to achieve higher yield and better crop performance.

Keyword **:** *Sesamum indicum L.*, Seed coating, Seed pelleting, Potassium nitrate, Seed yield.

Introduction

Sesamum (*Sesamum indicum* L.) is one of the oldest and most important oilseed crops cultivated across tropical and subtropical regions of the world. It belongs to the family *Pedaliaceae* and is widely grown. Sesamum is an ancient oilseed crop grown in tropical to temperate regions of the world for its flavour and high-quality oil (Kant *et al*., 2021; Rathod *et al*., 2021)., which is rich in unsaturated fatty acids and natural antioxidants such as sesamin and sesamolin. India is considered a secondary center of origin and is among the largest producers of sesame globally. Major sesame-growing states in India include Madhya Pradesh, Uttar Pradesh, Rajasthan, and Gujarat, where it is predominantly cultivated by small and marginal farmers under rainfed conditions. However, despite its nutritional and economic importance, sesame productivity in India remains low compared to its genetic potential, mainly due to poor crop establishment, irregular plant stand, and unfavorable field conditions.

Successful crop establishment in sesame depends greatly on the quality of seed and the initial field emergence, which are often influenced by soil moisture, temperature, and seed vigor. The small seed size of sesame makes uniform sowing, germination, and seedling establishment more challenging, especially under dryland and marginal environments. Hence, it is essential to improve field emergence and early seedling vigor through suitable pre-sowing seed enhancement techniques such as seed coating and pelleting. These techniques help in modifying the seed surface, enhancing germination, improving seedling growth, and ensuring uniform plant population under variable field conditions. (Taylor *et al*., 1998)

Seed coating and pelleting are important agronomic interventions that can improve the physical, physiological, and nutritional environment of the seed. Coating helps in adhering beneficial materials such as nutrients, protectants, and stimulants to the seed surface, whereas pelleting modifies the seed shape to facilitate precision planting and uniform emergence. Moreover, coating materials can serve as a source of essential macro- and micronutrients that support early root and shoot development, while fillers such as fly ash, gypsum, and organic powders can enhance aeration, water retention, and microbial activity in the rhizosphere. These improvements collectively result in better field establishment, vigorous plant growth, and higher yield potential (Rocha *et al*., 2019 a,b)

Field performance of sesame is also affected by the physiological condition of the seed at sowing and by environmental stresses during the early stages of growth. Under field conditions, variations in temperature, soil type, and moisture availability can influence emergence and stand establishment. Therefore, the use of effective seed coating and pelleting materials such as potassium nitrate, rice gruel, and fly ash can improve osmotic regulation, nutrient uptake, and overall plant vigor, leading to higher productivity. Potassium nitrate acts as a chemical stimulant that promotes enzymatic activity and early germination, while rice gruel serves as a natural adhesive and nutrient medium, and fly ash contributes to better root aeration and moisture conservation.

Considering the importance of seed quality and uniform crop stand for achieving higher productivity in sesame, field-based evaluation of seed coating and pelleting treatments becomes essential. Hence, the present investigation entitled “Effect of Seed Coating and Pelleting on Seed, Seedling and Morphological Characters of Sesamum (*Sesamum indicum* L.)” was undertaken to study the influence of various coating and pelleting combinations on field emergence, growth parameters, and yield attributes of sesame under field conditions. This research aims to identify the most effective treatment for improving seed performance, crop establishment, and yield potential in sesame under the diverse environmental conditions of Gujarat.

Material and Methodology

Geographically, Sardarkrushinagar is situated at 240^0 19' North latitude and 72^0 19' East longitude with an elevation of 154.52 m above the mean sea level and situated in the North- Gujarat Agro-climatic region. Climate of this region is sub-tropical monsoon type and falls under semi-arid region.

The experimental field with sandy loam, fertile soil was prepared using tractor cultivation, planking, and 45 cm furrows. Soil was analyzed for nutrient status. Intercultural operations, including three hand weedings, were performed to maintain a weed-free field, ensuring favorable conditions for optimal sesame crop growth and development.

The pure seeds of sesamum varieties GT 4 (Gujarat Til 4) was obtained from Centre for Oilseeds Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, in *kharif* 2023 and *Summer* 2024.

The observations on different traits was recorded on five randomly selected competitive plants from the each entry, the average of that was worked out for further analysis. Like; Field emergence (%), initial plant population, days to 50 per cent flowering, number of branches per plant, plant height, number of

capsules per plant, number of seed per capsule, days to maturity, plant population at maturity and seed yield per plant (g) were analyzed using randomized block design (RBD) with four replications. (Panse and Sukhatme, 1985).

Table 1.1 : List of experimental treatments

Treatment	Details
T_1	Water priming + Acasia gum + No filler material
T_2	Water priming + Acasia gum + Gypsum
T_3	Water priming + Acasia gum + Fly ash
T_4	Water priming + Acasia gum + Neem leaf powder
T_5	Water priming + Acasia gum + Custard apple leaf powder
T_6	Water priming + Rice gruel + No filler material
T_7	Water priming + Rice gruel + Gypsum
T_8	Water priming + Rice gruel + Fly ash
T_9	Water priming + Rice gruel + Neem leaf powder
T_{10}	Water priming + Rice gruel + Custard apple leaf powder
T_{11}	Bijamrut priming + Acasia gum + No filler material
T_{12}	Bijamrut priming + Acasia gum + Gypsum
T_{13}	Bijamrut priming + Acasia gum + Fly ash
T_{14}	Bijamrut priming + Acasia gum + Neem leaf powder
T_{15}	Bijamrut priming + Acasia gum + Custard apple leaf powder
T_{16}	Bijamrut priming + Rice gruel + No filler material
T_{17}	Bijamrut priming + Rice gruel + Gypsum
T_{18}	Bijamrut priming + Rice gruel + Fly ash
T_{19}	Bijamrut priming + Rice gruel + Neem leaf powder
T_{20}	Bijamrut priming + Rice gruel + Custard apple leaf powder
T_{21}	Potassium nitrate (KNO_3) priming + Acasia gum + No filler material
T_{22}	Potassium nitrate (KNO_3) priming + Acasia gum + Gypsum
T_{23}	Potassium nitrate (KNO_3) priming + Acasia gum + Fly ash
T_{24}	Potassium nitrate (KNO_3) priming + Acasia gum + Neem leaf powder
T_{25}	Potassium nitrate (KNO_3) priming + Acasia gum + Custard apple leaf powder
T_{26}	Potassium nitrate (KNO_3) priming + Rice gruel + No filler material
T_{27}	Potassium nitrate (KNO_3) priming + Rice gruel + Gypsum
T_{28}	Potassium nitrate (KNO_3) priming + Rice gruel + Fly ash
T_{29}	Potassium nitrate (KNO_3) priming + Rice gruel + Neem leaf powder
T_{30}	Potassium nitrate (KNO_3) priming + Rice gruel + Custard apple leaf powder
T_{31}	Water + Rice gruel + Turmeric powder
T_{32}	Bijamrut + Rice gruel + Turmeric powder
T_{33}	Fungicide + Rice gruel + Turmeric powder
T_{34}	NPK consortium + Rice gruel + Turmeric powder
T_{35}	*Beauveria basiana* + Rice gruel + Turmeric powder
T_{36}	Water + Wheat gruel + Turmeric powder
T_{37}	Bijamrut + Wheat gruel + Turmeric powder
T_{38}	Fungicide + Wheat gruel + Turmeric powder
T_{39}	NPK consortium + Wheat gruel + Turmeric powder
T_{40}	*Beauveria basiana* + Wheat gruel + Turmeric powder

Results and Discussion

Effect of seed coating and pelleting on field character during sowing season

Among the all the coated and pelleted seeds differed significantly for seed yield and its attributing characters during sowing season. Among the sowing season, season-2 recorded higher value for field emergence percentage (75.43%), initial plant population (89.88), days to flowering (45.23 days), no. of primary branches per plant (3.04), plant height (106.27 cm), days to maturity (79.75 days), no. of capsule per plant (34.21), no. of seed per capsule (56.76), plant population at maturity (87.76) and seed yield per plant (7.74 gm) were recorded.

While, season-1 recorded lower value for field emergence percentage (62.64 %), initial plant population (74.75), days to flowering (37.63 days), no. of primary branches per plant (2.52), plant height (88.69 cm), days to maturity (96.32 days), no. of

capsule per plant (28.44), no. of seed per capsule (47.19), plant population at maturity (73.04) and seed yield per plant (6.44 gm) were recorded.

Effect of seed coating and pelleting on different field character on treatments

Among all the fourty treatments, treatment (T_{28}) potassium nitrate (KNO_3) + rice gruel + fly ash exhibited higher value in yield and its attributing characters *viz*., field emergence percentage (82.04 %), initial plant population (92.55), no. of primary branches per plant (3.63), plant height (119.48 cm), days to maturity (73.58 days), no. of capsule per plant (41.85), no. of seed per capsule (66.64), plant population at maturity (93.19) and seed yield per plant (11.05 gm) were recorded.

Among all the fourty treatments, treatment (T_1) water priming + acasia gum + no filler material exhibited lower value in yield and its attributing characters viz., field emergence percentage (59.00%), initial plant population (68.09), no. of primary branches per plant (2.01), plant height (76.62 cm), days to maturity (96.32 days), no. of capsule per plant (18.62), no. of seed per capsule (37.35), plant population at maturity (65.75) and seed yield per plant (4.01 gm) were recorded.

Irrespective of the seed coating and pelleting treatments, significantly the highest and lowest days to maturity (73.58 and 104.87 days) were recorded in (T_{28}) potassium nitrate (KNO_3) + rice gruel + fly ash and (T_{36}) Water + wheat gruel + turmeric powder, respectively.

Interaction effect between sowing season and treatments

The interaction between sowing season and treatments recorded non-significant difference for yield and its attributing characters for all recorded observations except seed yield per plant (gm) is found significant. However, interaction between sowing season and treatments has found higher in treatment T_{28} in season-2 (11.90 gm) seed yield and lower (3.67 gm) seed yield in treatment T_1 in season-1.

Similar findings were reported by Longjiang *et al*., (1997) and Shashibhaskaret *et.al*., (2008) in tomato, Singh and Verma (1991), Dogan and Zeybek (2009) and Prakash *et al*., (2014), and Alex *et al*., (2017).

Conclusion

From the present studies, it can be concluded that sesamum seed coated and pelleted with potassium nitrate (KNO_3) + rice gruel + fly ash resulted in better plant growth, earliness and seed yield as well as improved seed quality and its related parameter.

The improved performance is due to the synergistic effect of KNO_3, rice gruel, and fly ash, potassium nitrate (KNO_3) acts as a source of readily available nitrogen and potassium, which enhances seed germination, early growth, and metabolic activity, rice gruel provides natural carbohydrates and micronutrients that support microbial activity and seedling vigor, fly ash improves soil texture and supplies trace minerals like calcium, magnesium, and silica, enhancing nutrient uptake and root development.

Germination and vigour of sesamum seed coated and pelleted with potassium nitrate (KNO_3) + acasia gum + fly ash resulted increase in seed germination percentage, vigour index-I and vigour index-II. However, Effect of seed coating and pelleting on plant growth, yield, seed germination and viability are found very low in treatment (T_1) water priming + acasia gum + no filler material than rest of treatments. Seed germination and its related parameters are decrease with increase in storage time.

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Table 1.1: Influence of different treatments and season interaction on germination and its attributes traits of sesamum cv. GT 4.

Treatment	Field emergence (%)	Initial plant population	Days to flowering	No. of Primary branches per plant	Plant height (cm)	No. of capsule per plant	No. of seed per plant	Days to maturity	Plant population at maturity	Seed yield per plant (g)
T_1	59.00	68.09	46.31	2.01	76.62	18.52	37.35	93.81	65.75	4.01
T_2	62.32	74.84	41.02	2.23	79.09	24.47	41.39	88.02	67.39	4.36
T_3	59.85	87.01	49.75	2.93	81.81	20.60	38.95	85.49	66.23	4.38
T_4	75.86	73.06	33.23	3.25	80.20	24.51	38.42	89.73	74.06	4.56
T_5	62.48	85.45	45.65	2.88	80.95	29.86	42.60	87.38	67.46	4.35
T_6	65.76	71.49	49.59	3.32	103.80	32.82	61.24	89.97	89.59	7.53

T_7	69.73	73.86	35.01	2.52	116.31	30.55	47.00	94.93	75.60	5.85
T_8	74.66	73.19	34.57	2.70	111.75	28.55	58.62	97.62	71.43	7.06
T_9	72.69	80.67	41.33	2.28	106.69	22.47	60.28	86.02	90.09	4.64
T_{10}	62.12	89.10	48.43	2.98	95.05	26.60	60.72	102.00	86.80	5.05
T_{11}	72.21	85.89	43.78	3.46	106.33	24.02	47.19	98.79	79.75	5.24
T_{12}	73.62	79.14	42.91	2.75	85.62	23.86	49.86	91.32	74.13	4.89
T_{13}	66.46	77.58	48.73	2.36	84.78	32.10	54.62	95.78	79.50	5.22
T_{14}	76.98	87.10	48.72	3.48	98.69	27.38	59.20	95.45	83.25	7.55
T_{15}	60.94	78.88	47.01	2.52	92.39	32.31	57.74	79.97	80.52	5.23
T_{16}	68.75	70.44	41.68	3.20	108.90	32.76	50.55	81.36	68.68	5.42
T_{17}	67.96	86.06	41.62	2.04	108.67	34.27	52.00	92.88	75.61	5.02
T_{18}	71.79	88.52	44.51	2.14	97.43	30.69	41.68	92.52	82.33	7.75
T_{19}	60.96	70.04	34.26	3.06	82.38	30.93	46.52	87.33	87.80	7.48
T_{20}	71.90	77.93	39.47	3.20	93.42	39.99	49.03	88.74	85.38	9.45
T_{21}	66.17	91.35	47.95	2.97	104.91	33.97	54.01	82.04	82.85	9.21
T_{22}	63.24	85.38	43.43	2.04	109.36	36.65	63.05	75.34	82.63	9.42
T_{23}	80.88	80.03	40.03	3.49	81.57	37.15	59.34	76.69	83.78	9.83
T_{24}	76.87	90.13	33.52	3.52	102.84	39.94	63.83	78.33	87.33	10.76
T_{25}	76.80	82.02	37.20	2.44	94.17	31.98	55.78	75.95	90.69	10.00
T_{26}	77.52	79.25	50.93	3.43	114.26	37.91	63.85	76.87	89.03	9.60
T_{27}	77.92	88.83	32.02	2.87	113.77	40.56	63.59	81.31	89.93	9.61
T_{28}	82.04	92.55	33.54	3.63	119.48	41.85	66.64	73.58	93.19	11.05
T_{29}	76.19	87.62	38.75	2.94	115.84	39.92	63.18	77.21	82.46	9.75
T_{30}	79.81	81.70	35.80	2.43	116.42	40.34	59.25	80.02	82.15	9.74
T_{31}	60.96	88.00	43.31	2.14	115.44	34.47	50.83	81.87	87.48	7.63
T_{32}	75.87	88.87	41.52	2.74	82.10	28.48	53.08	82.02	71.33	6.54
T_{33}	61.69	81.40	42.79	3.09	96.09	21.14	45.79	93.53	83.01	7.98
T_{34}	62.71	88.79	33.37	2.81	95.79	28.20	40.19	86.14	81.79	6.54
T_{35}	66.89	77.97	41.63	2.25	83.71	32.03	45.84	90.95	68.72	7.16
T_{36}	70.05	82.57	39.69	2.56	93.50	34.29	44.96	104.87	77.72	6.85
T_{37}	62.70	87.64	45.49	2.79	92.29	32.68	43.75	99.29	74.94	6.22
T_{38}	61.77	89.84	43.73	2.41	83.51	36.22	50.45	96.26	84.22	5.05
T_{39}	62.73	88.40	34.03	2.54	111.74	21.90	44.61	96.11	85.08	8.18
T_{40}	62.70	82.05	40.97	2.95	82.41	36.18	52.07	94.20	85.80	7.53
S.Em. ±	1.47	1.73	1.17	0.09	2.85	0.71	1.31	2.31	2.16	0.24
CD @ 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.68

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