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Optimizing Sugarcane Cultivation: Efficacy of Single-Bud Pelleting on Emergence and Quality Traits

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ABSTRACT

Objective: The commercial cultivation of sugarcane is often associated with high production costs due to the extensive use of planting material and waste of energy, long cultivation periods, rapid deterioration of cuttings after bud establishment, labor-intensive operations, frequent machinery use, and heavy applications of fertilizers and pesticides. This study evaluated the efficacy of pelleting lateral buds of sugarcane stalks to produce single-bud seed pieces suitable for mechanized cultivation at the Sugarcane Development, Research, and Training Institute Khuzestan, Iran.

Methods: A split-plot experiment based on a randomized complete block design with three replications was conducted in 2021 at SDRTI, Khuzestan, Iran. The considered factors were different planting dates: 16 August (D1), 16 September (D2) and 17 October (D3) as main plots, and the pellet types (A1 (starch + peat + micro-combi fertilizer), A2 (starch + peat + nutritional compounds + Potassium silicate + carbendazim fungicide), A3 (single-bud without pellet), and A4 (50 setts without pellet- control)) as subplots.

Results: Pelleting single-bud seeds, particularly treatment A2 planted in September, significantly enhanced crop establishment, increasing emergence percentage by 56% and emergence rate to 2.85 sprouts per day compared to the control. Pelleting also improved growth and quality indices more effectively than other treatments.

Conclusions: Pelleting single-bud sugarcane seeds with nutrient-enriched coatings improves emergence, supports early crop growth, and facilitates mechanized cultivation. This technique supports mechanized planting by improving nutrient delivery and moisture retention at the bud level, contributing to more sustainable, efficient, and cost-effective sugarcane cultivation.

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Highlights:

- Pelleting with treatment A2 significantly enhanced emergence percentage and rate of sugarcane single buds by delivering essential nutrients.
- September planting, combined with pelleting, improved early growth and establishment of sugarcane plants.

Introduction

Sugarcane (*Saccharum spp.* L.) is an economically important crop cultivated in tropical and subtropical regions for its high sucrose content, bioenergy potential, and tolerance to drought (Bunphan et al., 2025). Commercial sugarcane propagation relies on vegetative setts 30–50 cm in length containing 3–4 buds. Approximately 8 to 10 percent of the total yield is used as planting material, making the process economically inefficient, as setts preparation accounts for over 20% of total production costs. In conventional systems worldwide, about 8 to 9 tons of sugarcane are used as planting material, and this high volume of material used can create challenges in the transportation, displacement, and storage of sugarcane, leading to rapid deterioration and a decrease in bud viability. An effective alternative to reduce planting material volume and improve sugarcane quality is the use of sugarcane single-buds (Jain et al., 2011).

Previous research (Jain et al., 2011) has demonstrated that a small segment of sugarcane stalk containing a single viable bud, along with minimal surrounding tissue and root primordia, is adequate for germination. Such single-bud cuttings can establish successfully under favorable conditions, supporting their use in efficient and resource-saving sugarcane propagation systems. In this regard, several researchers have demonstrated the feasibility of removing the inter nodal section and using single buds for mechanized planting, although their efforts were limited to small-scale experiments (Iqbal et al., 2002; Tamilselvan, 2006). It has been reported that the highest net yield can be achieved in this system due to the efficient use of cuttings, leading to about 80% savings in planting material (Nare et al., 2019). Despite these advantages, this cultivation system (single-bud) is not commercially viable due to the rapid loss of moisture and early decay under field conditions (Jain et al., 2011). To address this limitation, one promising technique for improving germination percentage and rate, as well as the emergence, durability, and quality of individual buds (hereafter referred to as "seeds"), is pelleting and coating.

High-quality seed cultivation has long been in demand among farmers and can enhance crop performance by up to 30%. Pelleting with suitable materials enables the localized release of beneficial substances near the seed, which significantly improves emergence (Afzal et al., 2020). This technique provides protective and nutritive compounds directly around the seed, shielding it from adverse environmental conditions until germination (Guan et al., 2013). Furthermore, seed pelleting modifies soil moisture retention, which enhances emergence and seedling establishment (Piri et al., 2019; Paravar et al., 2023; Dalvi et al., 2021). By supplying essential nutrients, pelleting supports critical physiological processes such as rapid growth, chlorophyll synthesis, cell division, photosynthesis, root development, nitrogen fixation, and carbon assimilation—ultimately improving seedling vigor and structure (Tripathi et al., 2017). Positive outcomes from seed coating have also been reported by Sharma et al. (2022) and Taghizoghi et al. (2018). In addition to pesticides, herbicides, and growth regulators, pelleting allows for the incorporation of strengthening compounds in small, targeted amounts, tailored to the specific needs of the crop species (Sanchez et al., 2014). Moreover, coating materials can protect and support seed development under diverse environmental conditions, without negative side effects, thereby aligning with farmers' production goals (Guan et al., 2013).

Planting date is another critical factor affecting crop performance. Proper timing helps avoid extreme temperatures and drought stress during sensitive growth stages. Exposure to such unfavorable conditions during critical periods can significantly reduce both yield quantity and quality (Zander et al., 2021). An inappropriate planting date has been reported to lower emergence by 20–30% and reduce the plant's ability to tolerate early-season stresses, leading to weaker overall performance (Zander et al., 2021). Therefore, planting date is considered one of the most important agronomic factors for achieving high production and performance. In the context of changing climatic conditions, adjusting the planting date can optimize resource use efficiency by ensuring crop exposure to favorable growth conditions (Abbas et al., 2019).

In this regard, the Sugarcane Development, Research, and Training Institute (SDRTI) Khuzestan, Iran, has initiated a project to investigate the physical aspects of single-bud sugarcane seedling survival and storage. The project aims to enhance storage capacity and improve treatment through pelleting techniques applied at different planting dates, with the ultimate goal of enabling large-scale mechanized sugarcane planting.

Material and Method

The present study was carried out at the first research station of SDRTI Khuzestan, Iran. The site is located at 48°32′ E longitude and 30°59′ N latitude, with an elevation of 603.6 m above sea level. This experiment was conducted in 2021 using a split-plot within a randomized complete block design. The main plots included three different planting dates: 16 August (D1), 16 September (D2), and 17 October (D3), and the subplots comprised four types of pellets: A1 (starch + peat + micro-combi fertilizer), A2 (starch + peat + nutritional compounds + carbendazim fungicide), A3 (single bud without pellet), and A4 (50 cuttings without pellet).

The nutritional compounds comprised: humic acid, filter cake, micro-combi fertilizer, superabsorbent, and potassium silicate.

Components of micro-combi fertilizer include Mg: 1.28%; B: 1.62%; Cu: 0.604%; Mn: 3.2%; Zn: 4.25%; Fe: 4.25%; Mo: 0.059%; and S: 2%.

Soil samples were collected from five points across the experimental field at the Khuzestan Sugarcane Research Station. Composite soil samples were analyzed to determine their physical and chemical properties, which included Sand: 18.5%; Silt: 41%; Clay: 40.5%; EC: 0.69 dSm^{-1}; pH: 7.83; Na: 647.07 $mgkg^{-1}$; Ca: 320 $mgkg^{-1}$; Mg: 672 $mgkg^{-1}$; K: 152 $mgkg^{-1}$; NO_3: 0.06 $mgkg^{-1}$, and NH_4: 552.8 $mgkg^{-1}$ (Ajribzadeh et al., 2024).

Sugarcane stalks have distinct knots, each containing a node and an internode (with a length of 5 to 25 cm). Each node has a lateral sprout situated at an angle between the leaf and the stalk. For this experiment, commercial CP69-1062 varieties with 3 cm lateral buds were used. The buds were excised and pelleted with A1 (starch + peat + micro-comboi fertilizer) or A2 (starch + peat + nutritional compounds + carbendazim fungicide). Pellets were prepared by dissolving 60 g of starch in one liter of water and heating the solution. After cooling, the buds were immersed in the binder and subsequently coated with filler and nutritional compounds.

Nutritional compounds in A1 (10 gkg^{-1} micro-combi fertilizer) and A2 (45 gkg^{-1} superabsorbent) (Ghorbani et al., 2013), (10 gkg^{-1} micro-combi fertilizer), (12 gkg^{-1} humic acid) (Farzaneh et al., 2019), (10 gkg^{-1} filter cake) (Monjezi et al., 2014), and (10 gkg^{-1} potassium silicate).

The preparation of the pellets was conducted in laboratory conditions at 25°C. The pelleted single buds were transferred to a field for planting the following day. Each experimental plot measured 5×10 m and contained five rows of cultivation, with a net plot size of 45.75 m². Between 25 and 30 holes were prepared in each row for planting single buds. The holes, arranged in a zigzag pattern for optimal space use, were 8–10 cm deep and spaced 25–30 cm apart (Figure 1). After placing the buds in the holes, they were covered with a 3–5 cm soil layer, and the field was immediately irrigated. Meteorological data were recorded for the location in 2021 at SDRTI Station No. 1, Khouzestan (Figure 2). These data were used to align crop management practices for the prevailing climatic conditions. Crop management operations, such as irrigation, fertilization, and weed control, were consistent with standard practices in the region. Irrigation was scheduled according to plant requirements and applied through hydroflumes and adjustable valves. Weeds were manually removed throughout the growing season to maintain plot cleanliness.

Figure 1. Cultivation intervals and placement of single-buds of pelleting in the field

شکل ۱. فواصل کشت و نحوه قرار دادن تک جوانه‌های پلت شده در مزرعه

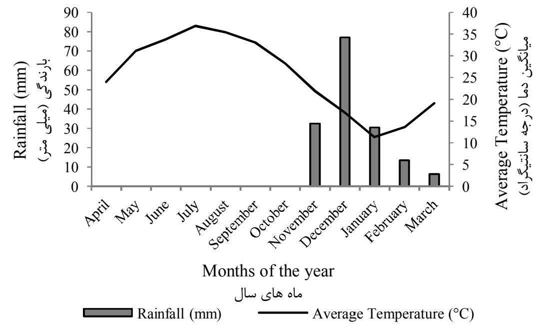


Figure 2. Average meteorological statistics of the sugar cane research station (number one) in the year 2021

شکل ۲. میانگین آمار هواشناسی ایستگاه تحقیقاتی نیشکر (شماره یک) در سال ۱۴۰۰

Stalk diameter: Ten stalks were randomly selected from each experimental plot. The stalk diameter was determined by measuring the upper, middle, and lower portions of each stalk, and the average of these three measurements was recorded.

Brix percentage: The Brix value, representing the soluble solid content of the syrup, was measured using a refractometer (Brix meter). A few drops of the extracted syrup were placed on the refractometer prism, the cover was closed, and the Brix reading was recorded (ICUMSA, 1999).

Pol percentage: Polarisability or "Pol," indicates the percentage of sugar present in the syrup extract. To measure the Pol, 100 milliliters of syrup extract were taken, and was mixed with 2 g of alkaline lead acetate and filtered through filter paper. The filtrate was then analyzed using a

Measurements

Seedling Emergence percentage (EP):

EP = (Ng / Nt) × 100

where:

- Ng = Number of emerged seedlings
- Nt = Total number of planted buds

Seedling Emergence rate (ER):

ER = Σ(N / D)

where:

- N = Number of emerged seedlings per day
- D = Day of emergence

polarimeter, and the corresponding Pol value was obtained (ICUMSA, 1999).

Purity percentage: The syrup purity was calculated as the ratio of Pol to Brix values, expressed as a percentage.

Statistical calculations

The collected data were analyzed using SAS, and graphs were generated with Excel software. Mean comparisons were performed using LSD tests at 5% probability.

Results

The analysis of variance (ANOVA) results indicated that planting date had a significant effect on seedling emergence percentage and rate, stalk diameter, Brix, Pol, and purity percentage at a 1% probability level. The pelleting was significant effect on seedling emergence percentage and rate at 1% and quality indices, including Brix, and Pol, at the 5% probability level. The interaction between planting date and pelleting significantly affected sugarcane growth and performance components, such as emergence percentage was significant at the 5% probability level, and for the emergence rate, this interaction was significant at a 1% probability level (Table 1).

Seedling emergence percentage and rate

Mean comparison results showed that the highest emergence percentage was observed in treatment D2A2, which was approximately 56% higher than the control (D2A4), and not significantly different from treatment D1A2 (Figure 3A). Following treatment A2, treatment A1 under the August planting date had a higher emergence percentage compared to other treatments at different planting dates. Across the three planting dates, the emergence percentage of single buds without pelleting and 50 cm cuttings was consistently lower than that of single pelleted buds in treatments A1 and A2, with the decline being more pronounced under the October planting date.

According to mean comparison (Figure 3B), the highest emergence rate was recorded in treatment D2A2 was 4.00 seedlings per day. The trend in emergence rate varied among pelleted, non-pelleted, and conventional planting methods. In

Table 1. Variance analysis of the effect of pelleting lateral buds of sugarcane stalk on growth components and qualitative indices of sugarcane in different cultivation dates

جدول ۱. تجزیه واریانس اثر پلت کردن جوانه‌های جانبی ساقه نیشکر بر اجزای رشد و شاخص‌های کیفی نیشکر در تاریخ‌های مختلف کشت.

Sources of variation منابع تغییر	Df درجه‌ی آزادی	Mean Squares (MS)					
		Seedling emergence percentage درصد سبزشدن	Seedling emergence rate سرعت سبزشدن	Stalk diameter قطر ساقه	Brix بریکس	Pol پل	Purity خلوص
Replication تکرار	2	5.08 ns	0.49 ns	2.58*	0.96ns	0.78ns	19.18**
Planting dates تاریخ کشت	2	1087.6**	24.94**	11.58**	19.25**	20.83**	20.36**
Error a خطایa	4	24.54	0.13	2.29	3.19	4.04	13.32
Pelleting پلت کردن	3	2467.2**	6.49**	0.66 ns	3.08*	3.43*	4.08 ns
Planting dates ×Pelleting تاریخ کشت×پلت کردن	6	275.9*	2.93**	0.13 ns	0.73ns	0.78ns	1.89 ns
Error b خطایb	18	103.2	0.30	0.53	0.67	0.67	1.45
Coefficient of variation (%) ضریب تغییرات (٪)		17.1	28.8	3.14	4.10	4.89	1.42

ns, * and **: Not-significant and significant at 5% and 1% probability levels, respectively.

ns، * و ** به‌ترتیب غیرمعنی‌دار و معنی‌دار در سطح احتمال ۵٪ و ۱٪

treatment A3, the emergence rate was lower at 0.86 seedlings per day compared to other treatments for various planting dates. Additionally, this index was lower for October planting dates (D3A3) compared with August (D1A3) and September planting dates (D2A3) (Figure 3B).

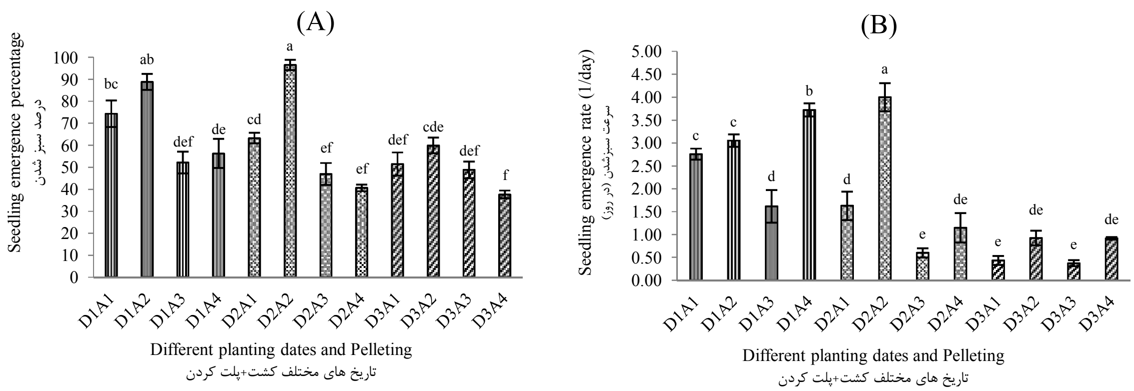
Stalk diameter

According to Table 2, no significant difference in stalk diameter was observed between August and September planting dates.

However, stalks planted in August, on average, are two millimeters thicker than those planted in October.

Qualitative indices (Brix, Pol, and purity percentage)

As shown in Table 2, no significant differences in quality indices were observed between the September and October planting dates, both of which were higher than August. Mean comparison of the pelleting effect indicated a 1% improvement in quality traits under A1, A2, and A3 treatments compared with the A4 treatment (Table 3).



D1A1=First type pellet+ August planting date
D1A1=تاریخ کشت مردادماه+پلت نوع اول
D1A2=Second type pellet+ August planting date
D1A2=تاریخ کشت مردادماه+پلت نوع دوم
D1A3=Single bud without pellet application + August planting
D1A3=تاریخ کشت مردادماه+تک جوانه بدون تیمار
D1A4=Normal cultivation without pellets+ August planting date
D1A4=تاریخ کشت مردادماه+کشت معمولی (قلمه ۵۰ سانتی‌متر)
D2A1=First type pellet+ September planting date
D2A1=تاریخ کشت شهریور ماه+پلت نوع اول
D2A2=Second type pellet+ September planting date
D2A2=تاریخ کشت شهریور ماه+پلت نوع دوم
D2A3=Single bud without pellet application + September planting
D2A3=تاریخ کشت شهریورماه+تک جوانه بدون تیمار
D2A4=Normal cultivation without pellets+ September planting date
D2A4=تاریخ کشت شهریورماه+کشت معمولی (قلمه ۵۰ سانتی‌متر)
D3A1 =First type pellet+ October planting date
D3A1=تاریخ کشت مهرماه+پلت نوع اول
D3A2=Second type pellet+ October planting date
D3A2=تاریخ کشت مهرماه+پلت نوع دوم
D3A3=Single bud without pellet application + October planting date
D3A3=تاریخ کشت مهرماه+تک جوانه بدون تیمار
D3A4=Normal cultivation without pellets + October planting date
D3A4=تاریخ کشت مهر ماه+کشت معمولی (قلمه ۵۰ سانتی‌متر)

Figure 3. Mean comparison of the effect of pelleting on emergence percentage (A) and emergence rate (B) of sugarcane in three different planting dates. Columns by the same letters, based on the LSD test, do not have a significant difference at the 5% probability level.

شکل ۳. مقایسه میانگین اثر پلت کردن بر درصد سبز شدن(A) ، و سرعت سبز شدن (B) نیشکر در سه تاریخ کشت مختلف. ستون‌های دارای حروف مشترک بر اساس آزمون LSD، در سطح احتمال ۵٪ اختلاف معنی‌داری ندارند.

Table 2. Mean comparison of the effect of different planting dates on the qualitative indicators of sugarcane in conventional planting and pelleted single-bud.

جدول ۲. مقایسه میانگین اثر تاریخ‌های مختلف کشت بر شاخص‌های کیفی نیشکر در کاشت معمولی و تک جوانه پلت شده

Planting dates تاریخ کشت	Stalk diameter(mm) قطر ساقه (میلی‌متر)	Brix (%) بریکس (٪)	Pol (%) پل (٪)	Purity (%) خلوص (٪)
August (D1) مرداد	24±0.22[a]	18.76±0.59 [b]	15.46±0.85 [b]	83.36±2 [b]
September (D2) شهریور	23±0.75 [ab]	20.75±0.19 [a]	17.82±0.32 [a]	85.84±0.8 [a]
October (D3) مهر	22±0.34 [b]	20.69±0.39 [a]	17.65±0.55 [ab]	85.26±1.11 [a]

Means by the same letters, based on the LSD test, do not have a significant difference at the 5% probability level

میانگین‌های دارای حروف مشترک بر اساس آزمون LSD، در سطح احتمال ۵٪ اختلاف معنی‌داری ندارند.

Table 3. Mean comparison of the effect of pelleting lateral buds of sugarcane stalk on the qualitative yield of sugarcane.

جدول ۳. مقایسه میانگین اثر پلت کردن جوانه‌های جانبی ساقه نیشکر بر شاخص‌های کیفی نیشکر

Types of pelleting نوع پلت	Brix (%) بریکس (٪)	Pol (%) پل (٪)
First type pellet (A1) پلت نوع اول (A1)	20.06±0.45 [a]	17.1±0.6 [a]
Second type pellet (A2) پلت نوع دوم (A2)	20.4±0.19 [a]	17.35±0.13 [a]
Single-bud without pellet application (A3) تک جوانه بدون اعمال پلت (A3)	20.35±0.37 [a]	17.38±0.29 [a]
Normal cultivation without pellets(A4) کشت معمولی بدون پلت (A4)	19.14±0.4 [b]	16.07±0.2 [b]

Means by the same letters, based on the LSD test, do not have a significant difference at the 5% probability level.

میانگین‌های دارای حروف مشترک بر اساس آزمون LSD، در سطح احتمال ۵٪ اختلاف معنی‌داری ندارند

Discussion

Seed and crop improvement is the first critical stage in plant production, as it not only enhances stress tolerance through regulation of biochemical pathways, gene expression networks, and physiological responses but also improves germination and crop structure (Zhao et al., 2020). In this study, pelleted single-bud lateral setts of sugarcane stalks were used to ensure rapid field establishment with high germination rates, suitable for large-scale mechanized cultivation.

Overall, positive effects on sugarcane growth and performance were observed, particularly in treatment A2, which included nutritional and fungicidal compounds. Enhanced establishment percentage and rate, combined with sufficient light interception and reduced competition for growth resources, resulted in higher yield. Similar findings were reported by Sanchez et al. (2014) in *Parthenium argentatum* (Guayule), where pelleted seeds demonstrated improved establishment under stressful conditions. Pelleting modifies seed shape and size, facilitating mechanical planting and enabling the incorporation of pesticides, herbicides, growth regulators, and amendments that enhance establishment.

Ben-Jabeur et al. (2023) reported that pelleting alters the internal seed environment, increasing acidity and enzyme activity, thereby promoting faster germination, emergence, and stronger root and stalk growth. Moreover, it has been suggested that the faster growth in roots and stalks, as well as accelerated plant establishment, may be evidence of increased and more rapid activity of enzymes in seeds when using the technique of covering and flattening seeds.

In research by Singh and Thakur (2022) examining the effect of pelleting bean seeds, an increase in growth has been reported compared to the control group. It has been suggested that pelleted bean seeds with a kidney shape not only increase growth and yield but also result in the production of high-quality seeds compared with the control group. Furthermore, it has been proposed that this increase in growth and yield may be due to the transfer of materials to the seed before planting, resulting in improved plant growth, increased height, and the number of branches in the vegetative stage, as well as an increase in the number of pods in the reproductive stage, ultimately leading to a higher plant yield. Also, this technology can directly impact photosynthetic pigments and photosynthetic efficiency, increase NADPH production, and enhance plant productivity, likely due to the expansion of leaf surface area and improved light utilization (Khatun et al., 2024).

"Growth indicators" are among the factors that have been studied in the cultivation of sugarcane. Sugarcane growth requires temperatures between 32–35 °C for optimal establishment. Weather data (Ajribzadeh et al., 2025) indicated that October planting experienced lower average temperatures (28.2 °C) compared with August and September (Figure 2). Consequently, emergence percentage and rate were reduced in October, consistent with previous findings in sorghum. In this regard, Zandar et al. (2021) demonstrated in their study on different cultivation dates of sorghum that the presence of cold soils and low ambient temperatures in the months before March can lead to a decrease in the percentage and rate of plant emergence, which can result in a decline in product performance. Similarly, another study that examined the effect of different cultivation dates, it was reported that the performance of sorghum plants in early cultivation dates was more than 50% higher than in late cultivation dates in the experimental plots. This difference was attributed to changes in weather conditions and decreasing temperatures (Uyi et al., 2022).

The product developed in this study was tailored to the moisture and nutritional needs of single buds. The development process involved selecting buds from stalks with minimal nutritional reserves, followed by the creation of a synthetic endosperm to supply essential nutrients for growth across various planting schedules. The observed enhancement in sugarcane emergence rates and establishment success is likely attributable to the integration of an optimized binder tailored to the sponge-like tissue of the single bud, ensuring adequate nutritional support. This formulation facilitated water uptake and accelerated enzymatic activity, promoting the efficient degradation, translocation, and assimilation of stored reserves, which collectively contributed to accelerated growth rates. Furthermore, the incorporation of fillers compatible with the tissue structure of the single bud provided sufficient aeration to support respiratory processes. This enabled rapid root development, germination, and emergence within a condensed timeframe. The product was engineered to accommodate a diverse range of sugarcane varieties, leveraging globally standardized techniques adapted from seed propagation protocols for other crops.

Conclusion

Due to their anatomical characteristics, single sugarcane buds are highly prone to rapid moisture loss, which can result in poor establishment or delayed growth under field conditions. To mitigate this, an artificial endosperm formulation was designed to supply adequate moisture and nutrients. Pelleting single buds with nutrient-enriched compounds (particularly treatment A2) significantly increased emergence percentage and rate, especially under August and September planting dates.

By encapsulating single buds with a nutritionally complete and moisture-retentive matrix, the early-stage establishment of sugarcane under field conditions was notably improved. Maintaining an optimal spacing of 25–30 cm allowed greater light interception and reduced competition, enhancing crop establishment.

The successful establishment of sugarcane using single-bud planting combined with proper spacing enhanced access to sunlight and minimized resource competition, ultimately leading to improved vegetative development. This approach yielded results comparable to traditional methods involving 50 cm stalk cuttings. Pelleted single-bud planting achieved comparable performance to conventional 50 cm stalk planting while reducing planting material requirements by 70–80%, shortening planting time, and lowering nutrient and fertilizer needs. These agronomic advantages were most evident under optimal planting distances (25–30 cm), which facilitated enhanced light use efficiency and resource distribution, while reducing intra-species competition. As a result, cultivation costs were significantly reduced when compared to conventional sugarcane planting practices. In addition, this method supports the integration of mechanized sugarcane cultivation through modern technologies, contributing to more sustainable and efficient agricultural production systems.

Authors' Contributions

Methodology, S.F., M.S., R.S.S., and A.K.; formal analysis, H.B.; investigation, Z.A.; writing-original draft preparation, Z.A.; writing-review and editing, S.F. and H.B.; supervision, S.F., and M.S.; project administration, S.F., and M.S.; All authors have read and agreed to the published version of the manuscript.

Data Availability Statement

Data available on request from the authors.

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Ethical Considerations

The authors avoided data fabrication, falsification, and plagiarism, and any form of misconduct.

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Conflict of Interest

The authors declare no conflict of interest.

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اطلاعات مقاله

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کلیدواژه‌ها:
پلت کردن
درصد سبزشدن
سرعت سبزشدن
سیلیکات پتاسیم
کود میکروکمبی

چکیده

هدف: کشت سنتی نیشکر اغلب به‌دلیل استفاده گسترده از مواد کاشت و هدر رفت انرژی، دوره‌های طولانی کاشت، زوال سریع قلمه‌ها پس از استقرار جوانه‌ها، عملیات پر زحمت، استفاده مکرر از ماشین آلات و کاربرد مقادیر زیاد کودها و آفت‌کش‌ها با هزینه‌های بالای تولید همراه است. این مطالعه به ارزیابی اثربخشی پلت کردن جوانه‌های جانبی ساقه‌های نیشکر جهت تولید قطعات بذر تک جوانه مناسب برای کشت مکانیزه در مؤسسه تحقیقات و آموزش توسعه نیشکر و صنایع جانبی خوزستان، ایران، پرداخته است.

روش پژوهش: در سال ۱۴۰۰، آزمایشی به‌صورت کرت‌های خرد شده در قالب طرح بلوک‌های کامل تصادفی با سه تکرار در مؤسسه تحقیقات، آموزش و توسعه نیشکر و صنایع جانبی خوزستان انجام شد. عامل اول شامل سه تاریخ مختلف کشت (۲۵ مرداد ماه، ۲۵ شهریورماه و ۲۵ مهرماه ۱۴۰۰) به عنوان پلات اصلی و عامل دوم شامل ۴ نوع پلت، (A1 (نشاسته+پیت+کود میکروکمبی)، A2 (نشاسته+پیت+ترکیب‌های تغذیه‌ای+سیلیکات پتاسیم+قارچ-کش کاربندازیم)، A3 (تک جوانه بدون پلت) و A4 (قلمه ۵۰ سانتی‌متر بدون پلت– شاهد) به عنوان پلات فرعی بودند.

یافته‌ها: پلت کردن بذرهای تک‌جوانه‌ای، به‌ویژه در تیمار A2 که در تاریخ کاشت شهریورماه کاشته شد، به‌طور قابل توجهی باعث افزایش استقرار محصول شد و درصد سبزشدن را ۵۶ درصد و سرعت سبزشدن را به ۲/۸۵ جوانه در روز نسبت به شاهد (A4) افزایش داد. پلت کردن همچنین شاخص‌های رشد و کیفیت را نیز تحت تأثیر مثبت قرار داد.

نتیجه‌گیری: پلت کردن بذرهای تک جوانه‌ای نیشکر با پوشش‌های غنی شده با مواد تغذیه‌ای، سبزشدن را بهبود می‌بخشد، از رشد اولیه محصول حمایت می‌کند و کشت مکانیزه را تسهیل می‌کند. به‌ویژه در تیمار A2 در تاریخ کشت شهریورماه باعث بهبود رشد و استقرار نیشکر در شرایط مزرعه‌ای شد. این روش با بهبود رساندن مواد تغذیه‌ای و حفظ رطوبت در اطراف تک جوانه، از کشت مکانیزه نیشکر پشتیبانی می‌کند و به کشت پایدارتر، کارآمدتر و مقرون به صرفه‌تر کمک می‌کند.

جنبه‌های نوآوری:

- پلت کردن به‌ویژه در تیمار A2 با تأمین مواد تغذیه‌ای ضروری، درصد و سرعت سبزشدن تک جوانه‌های نیشکر را به‌طور قابل توجهی افزایش داد.
- کشت در شهریورماه همراه با پلت کردن، رشد اولیه و استقرار گیاه نیشکر را بهبود بخشید.

استناد: عجریب‌زاده، زهرا؛ فرزانه، سلیم؛ شمیلی، محمود؛ بلوچی، حمیدرضا؛ سیدشریفی، رئوف و کرملاچعب، عزیز (۱۴۰۴). بهینه‌سازی کشت نیشکر: اثر بخشی پلت کردن تک جوانه بر سبزشدن و ویژگی‌های کیفی. *پژوهش‌های بذر ایران*، ۱۲ (۱)، ۱۴-۱. http://doi.org/10.61882/yujs.11.2.1

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ملاحظات اخلاقی

پیروی از اصول اخلاق پژوهش

نویسندگان اصول اخلاقی را در انجام و انتشار این پژوهش علمی رعایت نموده‌اند و این موضوع مورد تأیید همه آنهاست.

مشارکت نویسندگان

نویسنده اول: دانشجوی دکتری، تهیه و آماده‌سازی نمونه‌ها، انجام آزمایش و گردآوری داده‌ها، انجام محاسبات، تجزیه و تحلیل آماری داده‌ها، تحلیل و تفسیر اطلاعات و نتایج، تهیه پیش‌نویس مقاله

نویسنده دوم: استاد راهنمای اول پایان‌نامه، نظارت بر مراحل انجام پژوهش، بررسی و کنترل نتایج، اصلاح، بازبینی و نهایی‌سازی مقاله

نویسنده سوم: استاد راهنمای دوم پایان‌نامه، طراحی پژوهش، نظارت بر مراحل انجام پژوهش، بررسی و کنترل نتایج، اصلاح، بازبینی و نهایی‌سازی مقاله

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تعارض منافع

بنا بر اظهار نویسندگان این مقاله تعارض منافع ندارد.

حامی مالی

مقاله حاضر با حمایت مالی معاونت پژوهشی دانشگاه محقق اردبیلی- اردبیل انجام شد. همچنین حمایت مالی از این پژوهش از طرف مؤسسه تحقیقات و آموزش توسعه نیشکر و صنایع جانبی خوزستان در قالب طرح تحقیقاتی با کد (۱۲۹۱۹۸۰۱) انجام شده است.

سپاسگزاری

از مؤسسه تحقیقات و آموزش توسعه نیشکر و صنایع جانبی خوزستان به خاطر حمایت مالی و معنوی و همکاری صمیمانه در اجرای این پژوهش، سپاسگزاری می‌شود.