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# Effects of seeding rate on growth parameters and yield components of soft wheat in a no-till system in the Saïs area of Morocco

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Cereals are the main basic food commodity in Morocco. Yields are affected by various farming factors, among them tillage and seeding rates. Because of the changes in rainfall amounts and trends, many farmers are starting to switch to no-till systems as a conservation measure, but are still adopting high seeding rates, often exceeding 200 kg.ha$^{-1}$, in an attempt to maximize yields. The present study aims to evaluates the effect of seeding rate on growth, yield and economic return of soft wheat (*Triticum aestivum* L.) under a no-till system in the Saïs area (Meknès, Morocco). The trial was conducted during the 2023/24 cropping season at the Experimental Farm of the National Agriculture School of Meknès. Four seeding rates: 80 (T1), 120 (T2), 160 (T3), and 200(T4) kg.ha$^{-1}$, were arranged in a randomized complete block design with four replications. The 2023-24 season was considered a drought season with only 409 mm rainfall. At emergence, the higher seeding rates T4 achieved a plant density of 499 plants/m², followed by T3 (387 plants/m²), T2 (387 plants/m²) and T1 (222 plants/m²). At tillering stage, the highest stem density (734 stems/m²) was recorded for (T4), but this density decreased to 364 stems/m² at heading, with a stem mortality rate of 27%. In contrast, the lowest seeding rate (T1) maintained an average of 0.5 tillers/plant. Plant height varied significantly across growth stages, with the T1 treatment exhibiting the tallest plant height of 71.7 cm by the end of the growing season, while the T4 treatment was the shortest with 33.5 cm, highlighting the strong impact of competition on growth. Total dry matter per plant was highest for T1, reaching 5.0 g compared to 2.0 g for T4. Spike density was significantly influenced by seeding rate, with T4 yielding an average of 364 spikes per square meter, whereas T1 produced 269 spikes/m². Chlorophyll content varied among treatments, with the 120 kg/ha seeding rate showing the highest value (39.1 µg/cm²) while the 200 kg/ha treatment had the lowest (33.5 µg/cm²). Grain yields were 30.5 quintal/ha for T1, 31.4 quintal/ha for T2, 28.4 quintal/ha for T3 and 31.0 quintal/ha for T4. Biological yields were 50.5 quintal/ha for T1, 51.2 quintal/ha for T2, 50.4 quintal/ha for T3, and 54.7 quintal/ha for T4. The economic analysis showed that despite the strong competition at higher seeding rates, the 200 kg/ha seeding rate offered the highest net returns, primarily due to the high price of straw during the drought season, which compensated for the lower grain yield per plant.

**Keywords:** seeding rate, no-till, soft wheat, growth parameters, grain yield, Morocco

# INTRODUCTION

Morocco faces increasing challenges of water scarcity and climate variability, significantly impacting agricultural productivity, particularly of field crops like soft wheat (Triticum aestivum L.). With the recurrent drought and rainfall disparities, adapting farming practices to these climatic pressures is essential. Seeding rate is considered a crucial factor that influences plant competition for water and nutrients (Walsh and Walsh, 2020). Despite rainfall shortage, farmers in Morocco are still using high seeding rates, often exceeding 200 kg/ha, which intensifies competition and leads to inefficiencies and higher production costs.

Previous research has demonstrated the complex effects of seeding rates on wheat yield. High grain production in a no-till system was achieved with a seeding rate of 150 kg/ha, resulting in a 40% yield increase compared to lower rates (Lafond and Gan, 2013). Similarly, increasing seeding rates in hard red winter wheat led to more spikes per unit area but fewer grains per head, though overall grain yield remained unaffected due to compensatory effects (Sunderman, 1999). In another study, a seeding rate of 300 kg/ha increased grain yield by 6-18% under wide-spaced sowing (Wang et al., 2021).

Thousand Grain Weight (TGW) typically decreases as seeding rates increase due to intensified plant competition, with a reduction of 6.9% observed when rates rose from 150 to 450 kg/ha (Wang et al., 2021). Similarly, grain weights varied minimally between 28.7 mg and 29.2 mg, with heavier grains associated with lower seeding rates (Tompkins et al., 1991).

In this context, the present study aims to evaluates the impact of different seeding rates of soft wheat on growth parameters and yield and its components under a No-till system in the Saïs area (Meknès, Morocco).

# MATERIALS AND METHODS

The experiment was conducted in the experimental farm of the National School of Agriculture of Meknès (ENA Meknès; 33°50’06"N 5°28’17"W). The experiment was conducted during the 2023/24 growing season. The soil at the experimental site is a Calcixeroll, with its main characteristics shown in Table 1.

The experimental design was a Randomized Complete Block (RCB) with four replications and four treatments. The trial comprised 16 elementary plots, each with an area of 60 m² (20 m x 3 m). The total area of the experiment was 2346 m² including the alleys. The tested seeding rates were 80, 120, 160, 200 kg/ha, respectively designated as T1, T2, T3 and T4 and sowing depth was 4 cm. Each plot consisted of 16 rows of soft wheat, with an inter-row spacing of 20 cm. The treatments were randomly assigned within each block. The blocks were separated by 6 meters N-S and 3 meters E-W, ensuring sufficient space for operational movements and minimizing treatment interference.

The rainfall recorded at the experimental site during the 2023-2024 agricultural season (Table 1), reflects an important intra-season variability; from September 2023 to May 2024, a total of 409 mm was recorded. The highest rainfall amount occurred in March, reaching 142 mm, while September and May were particularly dry, receiving 0 and 3 mm, respectively (Table 2). The experiment trial was setup in November 29, 2023, and harvested in May 14, 2024, a period during which 343 mm of rainfall was accumulated. This total rainfall is considered indicative of a very dry year for soft wheat cultivation (Ait Houssa et al., 2016). In addition to rainfall, the temperature variation patterns were significant. Average temperatures reached their lowest in December (11.5°C) and peaked in May (18.3°C), with daily unusual extremes reaching 40°C in March and April. This period also experienced the Eastern (Chergui) wind, exacerbating the already dry conditions, particularly in April, which received only 54 mm rainfall. These climatic conditions created a challenging environment for soft wheat growth, reflecting broader regional climate trends. December was marked by an extended dry spell of nearly 30 consecutive days without rainfall, accompanied by abnormally high temperatures. Similarly, January and February experienced over 20 dry days with sustained thermal stress, further amplifying the severity of water and temperature constraints on crop development.

The preceding crop was a barley-vetch forage mixture during the 2022/2023 season. In line with conservation agriculture practices, no-tillage was adopted, marking the third consecutive year of no-till at this trial site. Sowing took place on November 29, 2023, using a GIL direct seeder, strategically timed before an anticipated rainfall of 18 mm. A basal fertilizer (10-20-10 NPK) was applied at 150 kg/ha during sowing, followed by two top-dressings of nitrogen with 60 kg/ha at tillering and 40 kg/ha at stem elongation using ammonium nitrate (33.5%). Weed control targeted broadleaf weeds, and three manual weedings were carried out to manage a few monocotyledons. Disease control consisted of preventive fungicide applications targeting Septoria and Fusarium to safeguard the wheat crop's health.

Data collection targeted two distinct types of plots to accurately measure crop growth parameters and yield components. The first plot type was dedicated to measuring seedling establishment, ear density and final yield, with each plot containing three 1 m² subplots arranged in six rows of soft wheat. Two subplots were positioned 3.5 meters from the plot edges, while the third was centrally located to minimize edge effects and ensure representative sampling. To assess dry matter accumulation and plant height, additional plots were set up 1 meter away from each side of the central 1 m² plot. This configuration allowed for plant removal without disrupting primary yield measurements. Dry matter samples were oven-dried at 80°C for 48 hours. Additionally, chlorophyll content was measured at the end of flowering growth stage using the 'Dualex Force A' sensor.

To evaluate the economic profitability, assessment included both fixed and variable costs (Table 3; Aboudrare et al., 2024).

Statistical analysis (ANOVA univariate model) was achieved using IBM SPSS software. Post-hoc Student-Newman-Keuls (SNK) tests were used to further identify specific differences among the treatments.

# RESULTS AND DISCUSSION

### Stem Density

Stem density exhibited dynamic changes throughout the growing season, reflecting the influence of seeding rates and environmental conditions. After emergence, higher seeding rates, particularly T4, achieved a peak density of 499 plants/m² at the one shoot stage, followed by T3 (387 plants/m²), T2 (387 plants/m²) and T1 (222 plants/m²), with subsequent increases to 735 stems per square meter during tillering due to favorable cumulative rainfall (61 mm) up to this stage (Figure 1). However, a significant decline in stem density was observed as the season progressed, primarily attributed to lack of rainfall and thermal stress. By the jointing stage, T1 decreased to 506 stems/m², and T4 decreased to 610 stems/m² (Figure 1). This downward trend continued throughout the booting stage, with T1 falling to 364 stems/m² and T4 stabilizing at 364 stems/m² by the heading stage (Figure 1). The lowest stem densities were recorded during heading, highlighting the combined effects of increased competition and environmental stress. Notably, T1 exhibited a 21.2% increase in stem density, indicating that lower seeding rates may enhance stems survival and development, while T4 faced a 27.0% decline, underscoring mortality due to adverse conditions (Figure 1). This stem mortality can be explained by intra-specific competition that is enhanced by environmental stress (Darwinkel,1978).

### Plant height

Plant height varied significantly across all stages. Early in the season, at tillering stage, the T1 exhibited the tallest plants (35.9 cm), while the T4 treatment (200 kg/ha) was the shortest (32.2 cm), showing that lower seeding rates faced less competition. This trend persisted through booting stage, with the T1 treatment reaching 59.5 cm, significantly taller than the T4 treatment at 51.9 cm. By jointing stage, the gap began to close as the T2 treatment approached the T1 treatment, with 69.8 cm and 71.7 cm, respectively. By Maturity, growth plateaued, with the T1 treatment maintaining a slight lead at 71.7 cm (Figure 2).

The growing season was characterized by extreme environmental stress, with higher-than-average temperatures and significantly below-average rainfall. These challenging conditions amplified competition among wheat plants (mainly for light, water and nutrients), particularly in plots with higher seeding densities. Under these conditions, higher seeding rates, such as the T3 and T4 experienced a more pronounced reduction in plant height. This reduction is closely linked to physiological responses to water stress due to drought conditions that may lead to diminished cell turgidity, which restricts both cell division and cell expansion (Arnon, 1971). This reduction in plant height can also be explained by the dehydration of the protoplasm under such stress conditions that directly affects cell turgidity, leading to decrease in growth (Salam et al., 2022).

### Tillering

The monitoring of tiller development across growth stages revealed a clear trend of decline across all seeding densities. Initially, T1 exhibited the highest average tiller number of 1.81 tillers/plant, significantly outperforming the higher densities, with T4 showing an average of 0.47 tillers per plant. However, by maturity, the situation had drastically changed, as T1 treatment fell to 0.50 tillers per plant, while T4 had no tillers at all (Figure 3). T1 initially had a high tiller count but experienced a significant decline of approximately 72.4% by the end of the season, suggesting that while it lost a substantial portion of its tillers, it retained a relatively higher tiller count compared to denser plantings. This indicates a certain resilience, as lower competition likely allowed for better resource allocation despite environmental stress. Conversely, T4 treatment exhibited a critical decline, leading to a total loss of tillers, which emphasizes the adverse effects of high seeding density. The physiological conditions of the main stem during tiller emergence and development play a critical role in this dynamic. When competition for resources, particularly photosynthates, intensifies due to increased seeding rates, it can lead to a diminished number of tillers per plant (Valério et al., 2008).

### Dry Matter Accumulation

Dry matter accumulation revealed significant differences ($p < 0.05$) across seeding rates at each growth stage. Lower seeding rates, particularly the T1, consistently showed higher dry matter per plant compared to higher seeding rates. For instance, during the early vegetative stage, T1 had the highest dry matter of 0.71 g/plant while T4 recorded 0.51 g per plant. As the growing season progressed, dry matter continued to increase, peaking at jointing stage, with T1 reaching 5.94 g per plant, compared to T4, which reached only 2.38 g per plant (Figure 4). This indicates that higher plant densities intensified competition for light, water, and nutrients, limiting individual plant biomass production. The clear reduction in dry matter production at higher seeding rates, indicates that high plant densities lead to increased competition for essential resources, ultimately limiting individual plant growth (Yadav and Dhanai, 2017). Dry matter decreases under both intra- and interspecific competition, optimal growing conditions promote high carbon assimilation rates and significant allocation of assimilates for stem storage (Aynehband et al., 2011). High seeding rates can create stress conditions that negatively impacts these processes. This decrease can also be explained by the decline of the photosynthesizing area and the volume of roots allowing the exploitation environmental resources (Aynehband et al., 2011).

### Phenological Transition

The impact of seeding rate on the growth stages of wheat reveals significant differences ($p < 0.05$) in plant development across different densities. Observations recorded on December 26, 2024, indicated that with T1, 80.2 % of plants had reached the three-leaf stage, compared to 75.5% for T2, 63.8% for T3 and 69.3% for T4 (200 kg/ha) (Table 4). The tillering stage, assessed on January 3, 2024, further illustrated the effects of seeding rate, as 61.2% of plants in the T1 reached this stage, while only 46.7% of plants at T4 reached it, highlighting the negative influence of higher planting densities on tiller development (Table 4). Moreover, by March 5, 2024, the heading stage displayed a marked contrast between the seeding rate treatments, as 80.5% of plants at T1 successfully reached this stage, while 54.1% for T2, 28.7% for T3 and only 10.8% for T4 achieved heading stage (Table 4; Figure 5).

The results show that higher seeding rates significantly impacted the phenological transition of wheat, primarily due to increased competition for resources such as light, water and nutrients. This competition delays the progression of plants through critical growth stages. For instance, with T4, fewer plants progressed to advanced growth stages such as complete spike emergence compared to lower seeding rates. Temperature and precipitation are additional critical environmental factors that affect wheat phenology and high temperatures or reduced precipitation can further limit resource availability, slowing the plant's development (Nakano and Morita, 2009).

**Chlorophyll Content**

Chlorophyll content, a key indicator of photosynthetic capacity and plant health, showed significant differences among the seeding rates. During the grain filling stage, T1 showed a mean chlorophyll content of 38.1 $\mu g/cm^2$, indicating reduced competition and enhanced photosynthetic activity. T2 recorded the highest mean value at 39.1 $\mu g/cm^2$, suggesting an optimal balance between plant density and resource availability. In contrast, T3 showed a decline to 36.1 $\mu g/cm^2$, while T4 registered the lowest chlorophyll content at 33.5 $\mu g/cm^2$, reflecting strong inter-plant competition and diminished photosynthetic efficiency at higher densities (Table 5).

Drought stress profoundly impacts the physiological and biochemical processes in crops, leading to a decline in chlorophyll content, which is critical for photosynthesis. As water availability diminishes, plants experience osmotic stress, resulting in the degradation of chlorophyll pigments. This degradation disrupts the photosynthetic machinery, impairing the plant's ability to efficiently convert light energy into chemical energy with a consequence of reduced photosynthetic capacity (Sharifi and Mohammadkhani, 2016).

**Yield components**

**Spikes density**

Spike density is significantly influenced by seeding rate, with T4 yielding an average of 364 spikes/m2. In comparison, T1 produced 269 spikes/$m^2$, while increasing the seeding rate to T2 resulted in a slight improvement to 275 spikes/$m^2$ (Table 6). These findings align with those of Carr et al. (2003) , who also reported a decrease in spike density at lower seeding rates.

**Grain yield**

Grain yield results indicated no significant effect of seeding rate on grain yield within the tested densities range. Average yields were consistent across treatments: 30.5 quintal/ha for T1, 31.4 quintal/ha for T2, 28.9 quintal/ha for T3, and 31 quintal/ha for T4 (Table 6). The differences are not statistically significant, which indicate no need for high seeding rates, and suggests that a lower seeding rate like T1 can lead to similar grain yield as that obtained at higher seeding rates.

**Straw yield**

Straw yield, a critical indicator of biomass production in wheat cultivation and an essential resource for livestock feed, was notably influenced by seeding rate. Unlike grain yield, straw yield responded positively to increased seeding densities. T4 produced the highest straw yield at 23.7 quintal/ha, highlighting the effectiveness of elevated plant density in maximizing biomass output. T3 also achieved a substantial yield of 21.5 quintal/ha. In contrast, T1 and T2 recorded lower yields, with 20 and 19.8 quintal/ha respectively, indicating that reduced seeding rates limit biomass accumulation due to lower plant density per unit area (Table 6).

**Biological yield**

Biological yield exhibited nonsignificant variability across the different seeding rates. T1 recorded 50.5 quintal/ha, while T2 yielded 51.2 quintal/ha. T3 achieved 50.4 quintal/ha and T4 reached the highest value at 54.7 quintal/ha, primarily due to its elevated straw yield (Table 6).

**Economic Analysis**

The total costs ranged from 3854 MAD for T1, 4020 MAD for T2, 4186 MAD for T3, and 4352 MAD for T4, with the difference due solely to seed costs as the other costs are fixed across different seeding rates. The price of the selected wheat variety used in this trial (Kenz) was 415 MAD/cw. The economic analysis shows that increasing the seeding rate led to substantial additional costs. For instance, transitioning from one treatment to another required an extra 40 kg/ha of seeds, which translated to an additional 166 MAD/ha (+50%). Further increases in seeding rates resulted in even greater financial burdens, with T3 costing 332 MAD/ha more (+100%) and T4 costing 498 MAD/ha more (+150% increase) compared to T1 (Table 7).

The analysis of grain yield showed that there were no significant differences among seeding rates. The grain production income for T1 was 8,388 MAD/ha, while T2 yielded 8,632 MAD/ha (an increase of 2.92%), T3 yielded 7,807 MAD/ha (a decrease of 6.92%), and T4 generated 8,531 MAD/ha (a slight increase of 1.70%). Conversely, straw yield income varied significantly with seeding rates. T1 produced 4,289 MAD/ha, T2 produced 4,246 MAD/ha (a decrease of 1.00%), T3 yielded 4,597 MAD/ha (an increase of 7.19%) and T4 achieved 5,076 MAD/ha (an increase of 18.7%) (Table 7).

The net margin analysis also indicated significant differences. T1’s net margin was 12,344 MAD/ha, while T2 was 12,380 MAD/ha (an increase of 0.29%), T3 was 11,740 MAD/ha (a decrease of 5.17%), and T4’s net margin was significantly higher at 12,777 MAD/ha (an increase of 8.83%). The increased profitability for T4 primarily results from its higher straw yield, which offsets the additional seeding costs. T1 experienced an 18.3% reduction in straw yield income compared to T4, highlighting T4’s advantages, especially during drought years when straw prices rise in the Moroccan context (Table 7).

This climatic uncertainty introduces a significant economic risk, particularly in relation to the value of by-products such as straw. In seasons with abundant rainfall, biomass production tends to be high, yet the market value of straw drops considerably. Conversely, in dry years, limited vegetative growth results in reduced straw availability, often leading to a sharp increase in its price. In such contexts, straw can represent a substantial share of the total revenue and significantly influence the net production margin. It is therefore essential that farmers integrate this dimension of risk into their decision-making process of seeding rate.

# CONCLUSION

In this study, seeding rate significantly influenced the growth parameters and yield components of soft wheat in a no-till system, with marked differences observed across treatments. T1 consistently outperformed the other treatments, demonstrating superior dry matter accumulation throughout the growth stages, with a peak of 5.94 g per plant compared to only 2.38 g for T4. Plant height followed a similar trend, with T1 exhibiting the tallest plants at 71.7 cm by the end of the growing season, while higher densities, particularly T3 and T4, resulted in reduced heights due to increased competition and environmental stress. Tiller dynamics further highlighted the impact of seeding rate: T1 recorded 0.50 tillers per plant, whereas T4 showed a complete absence of tillers, showing the negative effects of high plant density. Mortality rates were also strongly influenced, with T4 reaching 27% stem mortality, while lower rates had better plant survival. In terms of photosynthetic activity, T1 had a mean chlorophyll content of 38.1 µg/cm², reflecting reduced competition and greater photosynthetic efficiency, whereas T4 recorded the lowest value at 33.5 µg/cm². The economic analysis revealed that, although T4 resulted in lower grain yield, it provided the highest net margin, primarily due to the high market value of straw during the drought season in Morocco. Under such conditions, higher seeding rates may not enhance grain yield, but their greater straw yield can serve as a compensatory factor, supporting their use to optimize economic profitability.

# REFERENCES

Aboudrare A., Drissi S., Raid E. M., Boumya F. Z, Ech-Chami N., El Alaoui Ismaili W., El Ayssaly O., Zahid A. (2024). Prestation de services en Mécanisation Agricole au Gharb. Bulletin de Transfert de Technologie en Agriculture, 209: 1-14.

Ait Houssa A., Oubaki L., Reda-Fathmi K., Drissi Saad, Lamghari M., Benbella Mohamed, Chraibi H. (2016). Eléments agro-économiques pour la réussite de la culture du blé tendre en Bour. Bulletin de Transfert de Technologie en Agriculture, 202: 1-8.

Arnon I. (1971). Crop production In dry regions. Volume 1: Background and principles, 650 p.

Aynehband A., Asadi S., Rahnama A. (2011). Dry matter distribution as affected by N rates and intra-and interspecific competition in wheat (Triticum aestivum L.). J. Food Agric. Environ., 9: 354-363.

Carr P.M., Horsley R.D., Poland W.W. (2003). Tillage and seeding rate effects on wheat cultivars: II. Yield components. Crop Science, 43: 210-218.

Darwinkel A. (1978). Patterns of tillering and grain production of winter wheat at a wide range of plant densities. Netherlands Journal of Agricultural Science, 26: 383-398.

Lafond G.P., Gan Y. (2013). Row spacing and seeding rate studies in no-till winter wheat for the northern great plains. Journal of Production Agriculture, 12: 624-629.

Louali A. (Ed.). (2019). Le secteur agricole marocain: Tendances structurelles, enjeux et perspectives de développement. Ministère de l'économie et des finances, Direction des études et des prévisions financières.

Nakano H., Morita S. (2009). Effects of seeding rate and nitrogen application rate on grain yield and protein content of the bread wheat cultivar ‘Minaminokaori’in Southwestern Japan. Plant Production Science, 12: 109-115.

Salam A., Ali A., Afridi M.S., Ali S., Ullah Z. (2022). Agrobiodiversity: Effect of drought stress on the eco-physiology and morphology of wheat. In Biodiversity, Conservation and Sustainability in Asia: Volume 2: Prospects and Challenges in South and Middle Asia (pp. 597-618). Cham: Springer International Publishing.

Sharifi P., Mohammadkhani N. (2016). Effects of drought stress on photosynthesis factors in wheat genotypes during anthesis. Cereal Research Communications, 44: 229-239.

Sunderman H.D. (1999). Response of hard red winter wheat to seed density and seeding rate in no-till. Journal of Production Agriculture, 12: 100-104.

Tompkins D.K., Fowler D.B., Wright A.T. (1991). Water use by no-till winter wheat influence of seed rate and row spacing. Agronomy Journal, 83: 766-769.

Valério I.P., Carvalho F.I.F.D., Oliveira A.C.D., Machado A. D.A., Benin G., Scheeren P.L., Hartwig I. (2008). Desenvolvimento de afilhos e componentes do rendimento em genótipos de trigo sob diferentes densidades de semeadura. Pesquisa Agropecuária Brasileira, 43: 319-326.

Walsh S., Walsh L. (2020). Seeding rate and nitrogen fertilizer rate effect on dryland no-till hard red spring wheat yield and quality. Agrosystems, Geosciences and Environment, 3: 1–10.

Wang Z., Khan S., Sun M., Ren A., Lin W., Ding P., Gao Z. (2021). Optimizing the wheat seeding rate for wide-space sowing to improve yield and water and nitrogen utilization. International Journal of Plant Production, 15: 553-562.

Yadav M.S., Dhanai C.S. (2017). Effect of different doses of nitrogen and seed rate on various characters and seed yield of wheat (Triticum aestivum L.). Journal of Pharmacognosy and Phytochemistry, 6: 01-05.

## References