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TITRE

Evaluation of drought stress tolerance in different triticale varieties (× *Triticosecale* Wittmack) under controlled conditions.

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ABSTRACT:

Triticale (× *Triticosecale* Wittmack) is a cereal of agronomic interest in Mediterranean environments, where water deficit limits crop productivity. This study aims to characterize the growth, physiological, biochemical and yield responses of nine triticale varieties under well-watered and water-stressed conditions and to assess their variability across contrasting water regimes. The experiment was conducted under greenhouse conditions using a randomized complete block design with three blocks and three water regimes: well-watered (WW, 100% field capacity), moderate water stress (MWS, 50%) and severe water stress (SWS, 30%), imposed after heading. Compared with WW, SWS reduced plant height, leaf area, shoot biomass, grain yield and thousand-grain weight by approximately 8%, 28%, 42%, 58% and 45%, respectively, while root traits remained unaffected. Significant variety × water regime interactions were observed for several yield-related and biomass traits. V3 (Mezghenna), V7 (Bahdja) and V9 (Marmoura) maintained comparatively higher grain production under SWS, whereas V4 (Ain Soltan) showed marked yield reductions. Separate principal component analyses (PCA) under WW and SWS revealed contrasting varietal response patterns associated with vegetative growth, physiological status and yield components. Overall, the study highlighted substantial varietal variability and identified promising candidates for further evaluation under water-limited conditions.

Key Words: Triticale, Drought stress, Varietal response, Yield components, Physiological traits.

ملخص:

يُعدّ التريتيكال (*Triticosecale* Wittmack ×) من الحبوب ذات الأهمية الزراعية في البيئات المتوسطية، حيث يُحدّ العجز المائي من إنتاجية المحاصيل. تهدف هذه الدراسة إلى توصيف استجابات تسعة أصناف من التريتيكالي من حيث النمو والصفات المورفولوجية والفسيولوجية والكيميائية الحيوية والإنتاج، في ظروف الري الكافي والإجهاد المائي، وتقييم التباين بينها وفقًا لأنظمة مائية مختلفة. أُجريت التجربة داخل بيت بلاستيكي باستعمال تصميم الكتل العشوائية الكاملة بثلاثة كتل وثلاثة أنظمة مائية مبنية على السعة الحقلية: (الري الكافيWW ، بنسبة 100% من السعة الحقلية)، و(الإجهاد المائي المعتدل MWS ، بنسبة 50%) و(الإجهاد المائي الشديدSWS ، بنسبة 30%)، وذلك بعد مرحلة التسبيل. مقارنةً بمعاملة الري الكافي، أدى الإجهاد المائي الشديد إلى انخفاض ارتفاع النباتات بنحو 8%، والمساحة الورقية بنسبة 28%، والكتلة الحيوية للمجموع الخضري بنسبة 42%، ومحصول الحبوب بنسبة 58%، ووزن ألف حبة بنسبة 45%، في حين لم تتغير الصفات الجذرية. كما سُجّلت تفاعلات معنوية بين الصنف والنظام المائي بالنسبة إلى عدد من الصفات المرتبطة بالمحصول والكتلة الحيوية. حافظت الأصناف V3 (Mezghenna) و V7 (Bahdja) و V9 (Marmoura)على إنتاج حبوب أعلى نسبيًا تحت الإجهاد المائي الشديد، بينما أظهر الصنف V4 (Ain Soltan) انخفاضًا ملحوظًا في المحصول. وكشفت تحليلات المكونات الرئيسية(CPA) ، التي أُجريت بشكل منفصل في ظروف الري الكافي والإجهاد المائي الشديد، عن أنماط مختلفة لاستجابة الأصناف، ارتبطت بالنمو الخضري والحالة الفسيولوجية ومكونات المحصول. وبصفة عامة، أبرزت الدراسة وجود تباين واضح بين الأصناف، وحددت أصنافًا واعدة تستحق مزيدًا من التقييم في ظروف محدودية المياه.

الكلمات المفتاحية: التريتيكال، الإجهاد المائي، الاستجابة الصنفية، مكونات المردود، الصفات الفسيولوجية .

Résumé :

Le triticale (× *Triticosecale* Wittmack) est une céréale présentant un intérêt agronomique dans les environnements méditerranéens, où le déficit hydrique limite la productivité des cultures. Cette étude vise à caractériser les réponses morphologiques, physiologiques, biochimiques et productives de neuf variétés de triticale dans des conditions de bonne alimentation hydrique et de stress hydrique, ainsi qu'à évaluer leur variabilité selon différents régimes hydriques. L'expérimentation a été conduite sous serre selon un dispositif en blocs complètement randomisés comportant trois blocs et trois régimes hydriques : témoin bien irrigué (WW, 100 % de la capacité au champ), stress hydrique modéré (MWS, 50 %) et stress hydrique sévère (SWS, 30 %), appliqués après l'épiaison. Par rapport au témoin WW, le stress hydrique sévère a entraîné une réduction d'environ 8 % de la hauteur des plantes, 28 % de la surface foliaire, 42 % de la biomasse aérienne, 58 % du rendement en grains et 45 % du poids de mille grains, tandis que les paramètres racinaires sont restés inchangés. Des interactions significatives entre la variété et le régime hydrique ont été observées pour plusieurs caractères liés au rendement et à la biomasse. Les variétés V3 (Mezghenna), V7 (Bahdja) et V9 (Marmoura) ont maintenu une production en grains relativement plus élevée sous stress sévère, tandis que V4 (Ain Soltan) a présenté des réductions importantes du rendement. Les analyses en composantes principales (ACP), réalisées séparément sous WW et SWS, ont révélé des profils de réponse variétale contrastés, associés à la croissance végétative, à l'état physiologique et aux composantes du rendement. Dans l'ensemble, l'étude a mis en évidence une variabilité importante entre les variétés et identifié des génotypes prometteurs pour des évaluations ultérieures en conditions de disponibilité limitée en eau.

Mots clés : Triticale, Stress hydrique, Réponse variétale, Composantes du rendement, Traits physiologiques.

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