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TRITIKALI NAVLARINING HOSILDORLIGIGA MIKROELEMENTLARNING TA’SIRI

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Annotatsiya: *Ushbu maqolada tritikalening Sardor, Svat, Sergey, Tixon va Valentin navlarining hosildorligiga mikroelementlarning ta’siri o‘rganilgan. Tadqiqotlarda tritikale navlarini mikroelementlar bilan oziqlantirishning o‘simliklarning o‘sishi, rivojlanishi va hosil elementlarining shakllanishiga ta’siri tahlil qilindi. Mikroelementlar, xususan, rux (Zn), selen (Se), kremniy (Si) va bioazot qo‘llanilishining tritikale navlarining hosildorlik ko‘rsatkichlariga ta’siri baholandi. Tajriba natijalari mikroelementlar bilan oziqlantirish o‘simliklarning fiziologik holatini yaxshilashi, don hosil bo‘lish jarayonini faollashtirishi va hosildorlikning oshishiga ijobiy ta’sir ko‘rsatishini ko‘rsatdi. Navlar orasida mikroelementlarga javob reaksiyasida farqlar mavjudligi aniqlandi. Navlar kesimida eng yuqori hosildorlik Svat navining bioazot variantida 7612,08 kg/ga ni tashkil etdi. Valentin navida rux qo‘llanilganda 7476,04 kg/ga hosildorlik qayd etildi. Olingan natijalar tritikale navlarining hosildorligini oshirishda bioazot, rux va kremniy variantlari istiqbolli ekanligini ko‘rsatadi.*

Kalit so‘zlar: *Tritikale, nav, mikroelement, rux, selen, kremniy, bioazot, hosildorlik, don, hosil elementlari, mineral oziqlanish.*

ВЛИЯНИЕ МИКРОЭЛЕМЕНТОВ НА УРОЖАЙНОСТЬ СОРТОВ ТРИТИКАЛЕ

Аннотация: *В статье изучено влияние микроэлементов на урожайность сортов тритикале Сардор, Сват, Сергей, Тихон и Валентин. Проанализировано влияние микроэлементного питания на рост и развитие растений, а также формирование элементов урожайности. Оценено влияние применения микроэлементов, в частности цинка (Zn), селена (Se), кремния (Si) и биоазота, на показатели урожайности различных сортов тритикале. Результаты исследований показали, что применение микроэлементов способствует улучшению физиологического состояния растений, активизации процесса формирования зерна и повышению урожайности. Установлены сортовые различия в реакции растений на микроэлементное питание. Наиболее высокая урожайность среди изученных вариантов отмечена у сорта Сват при применении биоазота — 7612,08 кг/га. У сорта Валентин при внесении цинка урожайность составила 7476,04 кг/га. Полученные результаты свидетельствуют о перспективности применения биоазота, цинка и кремния для повышения урожайности сортов тритикале.*

Ключевые слова: *Тритикале, сорт, микроэлементы, цинк, селен, кремний, биоазот, урожайность, зерно, элементы урожая, минеральное питание.*

THE EFFECT OF MICROELEMENTS ON THE YIELD OF TRITICALE VARIETIES

Abstract: *This article investigates the effect of micronutrients on the yield of the triticale varieties Sardor, Svat, Sergey, Tikhon, and Valentin. The study analyzes the influence of micronutrient nutrition on plant growth and development, as well as on the formation of yield components. The effects of micronutrients, particularly zinc (Zn), selenium (Se), silicon (Si), and bio-nitrogen, on the yield performance of different triticale varieties were evaluated. The results showed that micronutrient application improved the physiological condition of plants, stimulated grain formation, and positively affected yield. Differences in the response of the studied varieties to micronutrient nutrition were identified. The highest yield was recorded in the Svat variety under the bio-nitrogen treatment, reaching 7612.08 kg/ha. In the Valentin variety, the application of zinc resulted in a yield of 7476.04 kg/ha. The obtained results demonstrate that bio-nitrogen, zinc, and silicon treatments are promising approaches for increasing the yield of triticale varieties.*

Keywords: *Triticale, variety, microelements, zinc, selenium, silicon, bio-nitrogen, yield, grain, yield components, mineral nutrition.*

Kirish

Tritikale bug‘doy va javdar genlarini birlashtirgan, yuqori hosildorlik va biologik xususiyatlari bilan ajralib turuvchi istiqbolli don ekinlaridan biridir. So‘nggi yillarda global iqlim o‘zgarishi hamda antropogen ta’sirlarning kuchayishi natijasida atrof-muhit holatining yomonlashuvi qishloq xo‘jaligi ishlab chiqarishi va oziq-ovqat xavfsizligiga jiddiy xavf tug‘dirmoqda. Ekinlarning o‘sishi, rivojlanishi va hosildorligiga salbiy ta’sir etuvchi asosiy abiotik omillar qatoriga yuqori harorat, tuproq sho‘rlanishi hamda qurg‘oqchilik kiradi. Ushbu omillar ta’sirida o‘simliklarda kechadigan fiziologik va biokimyoviy jarayonlar izdan chiqib, hosildorlik hamda mahsulot sifati pasayadi. Hozirgi vaqtda oziq-ovqat va yem-xashak bazasini mustahkamlash, don mahsulotlari yetishtirish hajmini oshirish hamda ekinlarning noqulay agroiqlim sharoitlariga chidamliligini kuchaytirishd a tritikalening ahamiyati ortib bormoqda.Tritikale hosildorligini oshirishda navning biologik xususiyatlari bilan bir qatorda tuproq unumdorligi, mineral oziqlanish, namlik bilan ta’minlanganlik va mikroelementlarning mavjudligi muhim ahamiyatga ega. Mikroelementlar o‘simliklarda fermentlar faoliyati, fotosintez, oqsil va uglevod almashinuvi, hujayra metabolizmi hamda generativ organlarning shakllanishida ishtirok etadi. Rux o‘simliklarda fermentativ jarayonlarning normal kechishi, o‘sish gormonlari sintezi va oqsil almashinuvida muhim rol o‘ynaydi. Selen esa o‘simliklarning antioksidant himoya tizimini faollashtirish va stress omillariga chidamliligini oshirishda muhim ahamiyatga ega. Kremniy o‘simlik hujayralari devorlarini mustahkamlash, suv almashinuvini tartibga solish, yotib qolishga, qurg‘oqchilikka va ayrim kasalliklarga chidamlilikni oshirishda ishtirok etadi. Shu sababli tritikaleni yetishtirishda ushbu mikroelementlardan samarali foydalanish hosildorlikni oshirishning muhim agrotexnik usullaridan biri bo‘lishi mumkin

Adabiyotlar tahlili

Abiotik stresslarning kuchayishi o‘simliklarda suv almashinuvi, fotosintez, mineral oziqlanish va antioksidant himoya tizimining buzilishiga olib keladi [10]. R. Ganguly tadqiqotlarida Zn va Se bilan ishlov berish qurg‘oqchilik, sho‘rlanish va og‘ir metallar stressi sharoitida xlorofill miqdorini saqlash, reaktiv kislorod shakllari hosil bo‘lishini cheklash va hujayra membranalari gomeostazini barqarorlashtirishi ko‘rsatilgan [10]. Shu jihatdan mikroelementlardan foydalanish o‘simliklarning oziqlanish holatini yaxshilash bilan birga stress ta’sirida yuzaga keladigan fiziologik buzilishlarni kamaytirishning samarali usullaridan biri hisoblanadi [19].

Yuqori harorat o‘simliklarning generativ rivojlanish bosqichini jadallashtirib, fotosintez mahsulotlarining meva va urug‘ hosil bo‘lishiga yo‘naltirilishini cheklaydi. Shuningdek, tuproq haroratining me’yoridan ortishi urug‘larning unib chiqish jarayoniga salbiy ta’sir ko‘rsatib, maysalarning bir tekis rivojlanishiga to‘sqinlik qilishi mumkin. Yuqori haroratning uzoq muddat davom etishi o‘simliklarning o‘sishi va rivojlanishini izdan chiqaradi, fiziologik jarayonlar muvozanatini buzadi hamda suv tanqisligini yanada kuchaytiradi. Natijada qurg‘oqchilik stressi chuqurlashib, hosildorlikning keskin pasayishiga, ayrim hollarda esa o‘simliklarning nobud bo‘lishiga olib kelishi mumkin [3].

Don hosil bo‘lishi va to‘lishi bosqichlaridagi haroratning o‘zgaruvchanligi don sifatiga sezilarli ta’sir ko‘rsatib, global qishloq xo‘jaligi uchun muhim muammolardan biri hisoblanadi. 2035-yilga borib dunyo bo‘yicha o‘rtacha harorat taxminan 0,35-0,70°C ga oshishi taxmin qilinmoqda [11]. Issiqlik stressi don to‘lish davrini qisqartiradi, bu bosqich oqsil va kraxmal to‘planishi uchun muhim bo‘lib, natijada umumiy oqsil miqdori kamayadi hamda uning tarkibi o‘zgaradi [15]. Rux (Zn) o‘simliklarda ko‘plab fermentlar faoliyatini boshqaruvchi muhim mikroelement bo‘lib, uning etishmasligi oqsil sintezi, ildiz tizimi rivojlanishi, fotosintez va hujayra membranasi faoliyatining pasayishiga olib keladi [14,9]. Rux 300 dan ortiq fermentlarning kofaktori sifatida ishtirok etib, auksin sintezi va o‘simliklarning o‘sishiga ham ta’sir ko‘rsatadi [2,18]. K.C. Dhiman tadqiqotlarida urug‘larga 500 ppm Zn bilan ishlov berish unish darajasini 85,33% gacha oshirib, maysa rivojlanishi va hujayra membranalari mustahkamligini yaxshilagan [7]. Ismail Cakmak ma’lumotlariga ko‘ra, Zn o‘g‘itlarini bargdan purkash yoki tuproqqa qo‘llash dondagi Zn miqdori bilan birga o‘simlik mahsuldorligi va stressga chidamliligini ham oshirgan [6].

Tritikale hosildorligi va em-xashak sifatini oshirishda Zn bilan oziqlantirishning samaradorligi bir qator tadqiqotlarda tasdiqlangan. Bonea D. tadqiqotlarida mikroelementlarga asoslangan agrotexnologiya tritikale don hosildorligini 52,4%, 1000 don massasini 17,2%, oqsil miqdorini 26,7% va natura og‘irligini 10,8% ga oshirgan [5]. Carlos García-Latorre tadqiqotlarida $ZnSO_4 \cdot 7H_2O$ ni tuproqqa va bargdan qo‘llash tritikalening em-xashak mahsuldorligi va sifatiga ijobiy ta’sir ko‘rsatgan; tuproqqa Zn berish biomassa hosilini 33% ga oshirgan [12]. Wang H. tadqiqotlarida 0,5% $ZnSO_4 \cdot 7H_2O$ bilan bargdan oziqlantirish tritikale va bug‘doy donida Zn to‘planishi hamda hosildorlikni oshirgan [20].

Selen (Se) ham o‘simliklarning stresslarga chidamliligini kuchaytiruvchi muhim elementlardan biri bo‘lib, o‘simlik tomonidan selenat, selenit va organik birikmalar, jumladan selenometionin shaklida o‘zlashtiriladi [8]. Uning samarasi qo‘llash shakli, konsentratsiyasi va genotipga bog‘liq bo‘lib, yuqori konsentratsiyalarda toksik ta’sir ko‘rsatishi mumkin [16,17]. C. García-Latorre tadqiqotlarida Se bilan ishlov berish tritikale biomassasini 14% ga oshirgan va 20 g Se/ga me’yori hosildorlik hamda em-xashak sifati o‘rtasida maqbul nisbatni ta’minlagan [13]. Se va Si ni birgalikda qo‘llash ham abiotik stresslarni yumshatishda istiqbolli yo‘nalish hisoblanadi. Ch. Ajmi tadqiqotlarida qurg‘oqchilik sharoitida tritikale

urug‘lariga Se va Si bilan ishlov berish hamda vegetatsiya davrida oziqlantirish biomassa va ildiz tizimi rivojlanishini yaxshilagan [1]. M. Cunha va R. Prado tadqiqotlarida Se va Si ni birgalikda qo‘llash ularni alohida ishlatishga nisbatan yuqoriroq hosildorlik va sifat ko‘rsatkichlarini ta’minlagan. P. Yakovlev tadqiqotlarida Se, Si va Zn bilan urug‘larga ekishdan oldin ishlov berish stress sharoitida ildizlarning nitratlarni o‘zlashtirish qobiliyatini saqlashi, fotosintez va oqsil sintezini jadallashtirishi aniqlangan [21].

Shunday qilib, adabiyotlar tahlili Zn, Se va Si kabi elementlar tritikalening stressga chidamliligi, fiziologik holati, biomassa shakllanishi, don hosildorligi va em-xashak sifatini yaxshilashda muhim ahamiyatga ega ekanligini ko‘rsatadi [1,5,13]. Biroq mikroelementlarning ta’siri ularning turi, qo‘llash usuli va me’yori, o‘simlik genotipi hamda stress omilining kuchiga bog‘liq [17]. Shuning uchun tritikale navlarida Zn, Se va Si ta’sirini fiziologik ko‘rsatkichlar, stressga chidamlilik va hosildorlik bilan bog‘liq holda kompleks baholash muhim ahamiyatga ega.

Tadqiqot metodologiyasi

Tadqiqotlar 2025 yilda Xorazm viloyatidagi Paxtachilik seleksiyasi, urug‘chiligi va agrotexnologiyalari ilmiy-tadqiqot institutining Xorazm ilmiy-tajriba stansiyasi tajriba maydonlarida olib borildi (41°19′60.00" N, 61°00′0.00" E). Tadqiqotda turli genotipik xususiyatlarga ega bo‘lgan Sardor, Svat, Sergey, Tixon va Valentin tritikale navlari o‘rganildi.

Dala tajribasi tasodifiy bloklar usulida (RCBD) 3 takrorda tashkil etildi. Har bir tajriba variantining maydoni 10 m² ni tashkil etdi. Tajribada Sardor, Svat, Sergey, Tixon va Valentin tritikale navlari nazorat, bioazot, rux, selen va kremniy variantlarida o‘rganildi. Umumiy 75 ta tajriba birligi tashkil etildi. Har bir tajriba birligining maydoni 6 m² (2 × 3 m), umumiy tajriba maydoni 450 m² ni tashkil etdi.

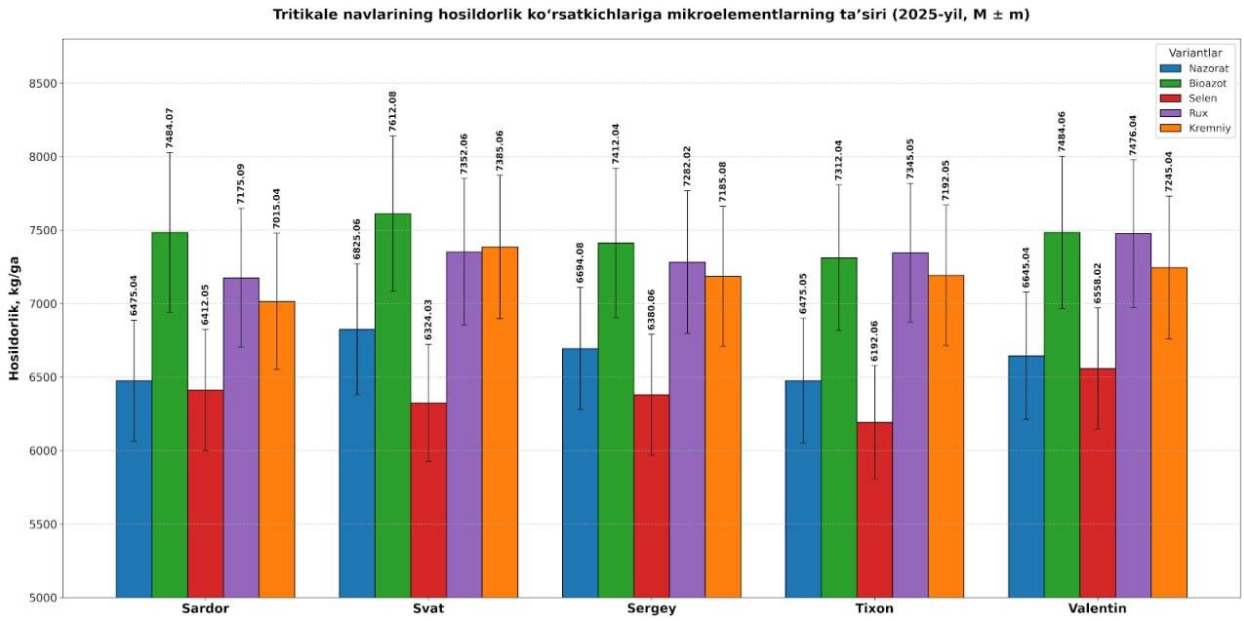
Hosildorlikni aniqlash maqsadida pishish davrida har bir variantdan 30 ta o‘simlik namuna sifatida olindi. Boshoq va don og‘irligi 0,01 g aniqlikda elektron tarozida o‘lchandi, boshoqdagi don soni sanab chiqildi, 1000 don massasi aniqlandi. Hosildorlik har bir variantning don massasi asosida hisoblanib, kg/ga da baxolandi.

Natijalar va ularning tahlili

2025-yilda olib borilgan tajribalar natijasida tritikale navlarining hosildorlik ko‘rsatkichlariga qo‘llanilgan mikroelementlar va oziqlantirish variantlarining ta’siri turlicha bo‘lgani aniqlandi. O‘rganilgan beshta nav orasida bioazot qo‘llanilgan variant eng yuqori natijani ko‘rsatdi. Bunda Svat navida hosildorlik 7612,08 kg/ga ni tashkil etib, barcha navlar va variantlar orasida eng yuqori ko‘rsatkich qayd etildi. Sardor va Valentin navlarida ham bioazot qo‘llanilganda mos ravishda 7484,07 va 7484,06 kg/ga hosildorlik olindi. Sergey navida ushbu ko‘rsatkich 7412,04 kg/ga, Tixon navida esa 7312,04 kg/ga ni tashkil etdi (1-rasm).

Rux qo‘llanilgan variantlarda ham yuqori hosildorlik kuzatildi. Xususan, Valentin navida 7476,04 kg/ga, Svat navida 7352,06 kg/ga va Tixon navida 7345,05 kg/ga hosildorlik qayd etildi.

Kremniy bilan ishlov berilgan variantlarda Svat navi 7385,06 kg/ga natija bilan ajralib turdi.



1-rasm. Tritikale navlarinig hosildorlik ko‘rsatkichlariga mikroelementlarning ta’siri, kg/ga

Bu natijalar rux va kremniy qo‘llash ham tritikale navlarining hosildorlik ko‘rsatkichlarini yaxshilashda istiqbolli ekanligini ko‘rsatadi. Selen qo‘llanilgan variantlarda esa barcha navlarda hosildorlik boshqa asosiy variantlarga nisbatan past bo‘ldi. Eng yuqori natija Valentin navida 6558,02 kg/ga, eng past natija esa Tixon navida 6192,06 kg/ga ni tashkil etdi. Shuningdek, selen variantidagi hosildorlik barcha navlarda nazorat ko‘rsatkichidan ham past bo‘ldi

Umuman olganda, tajriba natijalariga koʻra, bioazot qoʻllash tritikale navlarining hosildorligini oshirishda eng samarali variant boʻldi. Rux va kremniy ham ijobiy natijalar koʻrsatdi, biroq selen qoʻllanilgan variantlarda hosildorlikning pasayishi kuzatildi. Demak, tritikale yetishtirishda oziqlantirish variantlarini tanlashda navlarning oʻziga xos xususiyatlarini hisobga olish muhimdir

Xulosa

Olib borilgan tajriba natijalari tritikale navlarining hosildorlik koʻrsatkichlari qoʻllanilgan oziqlantirish variantlariga va navlarning biologik xususiyatlariga bogʻliq ravishda oʻzgarganligini koʻrsatdi. Oʻrganilgan variantlar orasida bioazot eng yuqori samaradorlikni namoyon etib, beshta nav boʻyicha oʻrtacha hosildorlik 7461 kg/ga ni tashkil etdi. Bu nazorat variantiga nisbatan taxminan 12,6% yuqori. Rux va kremniy qoʻllanilgan variantlarda oʻrtacha hosildorlik mos ravishda 7326 va 7204 kg/ga boʻlib, nazoratga nisbatan 10,6% va 8,8% ortish kuzatildi. Selen variantida esa oʻrtacha hosildorlik nazoratga nisbatan 3,8% past boʻldi.

Navlar kesimida eng yuqori hosildorlik Svat navining bioazot variantida 7612,08 kg/ga ni tashkil etdi. Valentin navida rux qoʻllanilganda 7476,04 kg/ga hosildorlik qayd etildi. Olingan natijalar tritikale navlarining hosildorligini oshirishda bioazot, rux va kremniy variantlari istiqbolli ekanligini koʻrsatadi.

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