

黄土塬区旱作农田长期定位施肥对冬小麦水分利用的影响

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Effect of long-term fertilization on winter wheat water utilization in rain-fed farmland of the Loess Tableland

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摘要 对长期定位施肥试验第22年度的测定数据进行了分析,探讨了旱地施肥对冬小麦水分利用的影响。试验结果表明,测定年份冬小麦的耗水深度受播种前雨季降雨入渗深度的影响位于地下200 cm左右。长期施肥单施磷肥处理,播种期土壤有效贮水量与不施肥的对照接近,而单施氮肥,氮磷配施和氮磷钾配施均显著低于对照;在施P₂O₅ 90 kg/hm²配施氮肥或施N 90 kg/hm²配施磷肥,随着施氮量或施磷量从0增加到180 kg/hm²,播种期土壤有效贮水量均逐渐降低,但前者作物的土壤水分消耗表现出降低趋势,而后者表现出增加趋势。与对照相比,各施肥处理均提高了土壤有效底墒的利用率。氮磷配施比单施磷肥降低了土壤供水占作物耗水的比例,使得作物生长和产量的形成对当季降水的依赖性增加。与对照相比,氮磷配施及氮磷钾配施显著提高了冬小麦收获指数、产量和水分利用效率,而单施磷肥和氮肥使收获指数、产量和水分利用效率显著降低。施P₂O₅ 90 kg/hm²的条件下,不同施氮量之间收获指数差异较小,而产量和水分利用效率均高于单施磷肥;施N 90 kg/hm²的条件下,不同施磷量作物的收获指数、产量和水分利用效率均得到提高。

关键词: 黄土高原 长期定位施肥 土壤水分 水分利用 冬小麦 黄土高原 长期定位施肥 土壤水分 水分利用 冬小麦

Abstract:

The water utilization of winter wheat in dryland farming was studied according to the data measured at the long-term fertilization experiment, which has been established for 22 years on the Loess Plateau. The results indicated that soil water consumption depth was affected by the infiltration depth during raining season before seeding, and it was as deep as 200 cm in the soil profile in the study year. As for ASWS(available soil water storage) at seeding stage after long-term fertilization, single phosphorus application treatment was similar to the controlled treatment, while single nitrogen application or mixed nitrogen-phosphorous application or mixed nitrogen-phosphorous-potassium application was less than the control treatment. For the mixed nitrogen with 90kg/ha phosphorus or mixed phosphorus with 90kg/ha nitrogen treatment, ASWS at seeding stage took a descendant trend as the nitrogen rates or the phosphorus rates increased from 0 to 180kg/ha, while for this experiment year, soil water consumption by crop was decreased by the former treatments contrary to the latter. For phosphorus application of 90 kg/ha, both available soil water content and soil water consumption of winter wheat in the study year were significantly decreased by increasing nitrogen application. For nitrogen application of 90 kg/ha, available soil water content was decreased with increased phosphorus application, while soil water consumption of winter wheat was increased. Compared with the control treatment, single phosphorus application, mixed nitrogen-phosphorous application, and mixed nitrogen-phosphorous-potassium application increased utilization rate of available soil water content. Mixed nitrogen-phosphorous application increased utilization rate of available soil water content in comparison with the single applications of the two fertilizers, but compared with single phosphorus application, mixed nitrogen-phosphorus application decreased the proportion of soil water consumption to crop water consumption and increased the dependency of crop yield on precipitation during the growing season. Harvest index, grain yield, and water use efficiency for mixed nitrogen-phosphorous application and mixed nitrogen-phosphorous-potassium application were all increased in comparison with single nitrogen application or single phosphorus application treatments. When phosphorus was applied at 90 kg/ha, the difference in harvest index for various nitrogen application rates was not significant, while grain yield and water use efficiency were higher than those in the case of single phosphorus application. When nitrogen was applied at 90 kg/ha, harvest index, grain yield, and water use efficiency at different phosphorus application rates were all increased in comparison with single nitrogen application.

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