水旱轮作条件下不同类型土壤供钾能力及钾素动态变化研究

Potassium supply capacity of and potassium dynamics in different types of soils under paddy rice - ryegrass rotation

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中文摘要:

采用盆栽试验，研究了黑麦草-水稻轮作条件下不同类型土壤供钾能力及钾素动态变化，以期为土壤供钾机制研究及合理的钾素调控提供依据。结果表明：不施钾条件下（NP处理），潮土上种植作物的生物量和吸钾量最高，黄褐土次之，红壤最低；施钾条件下（NPK处理），3种土壤上种植作物的生物量无显著差异，作物吸钾量为黄褐土>潮土>红壤。整个轮作期，红壤、黄褐土和潮土NPK处理的作物生物量较NP处理分别增加55.6%、45.2%和23.2%，作物吸钾量分别增加368.8%、166.8%和74.5%。轮作前季（黑麦草季），NP处理的3种土壤水溶性钾含量和交换性钾含量均降低，潮土非交换性钾含量明显降低，红壤和黄褐土非交换性钾含量在前期变化不大，中期有升高的趋势，后期显著降低；NPK处理的土壤钾含量均高于NP处理，且各种形态钾含量的变化趋势与NP处理基本相同。轮作后季（水稻季），NP处理的3种土壤水溶性钾含量变化不大，交换性钾含量呈先降低后升高的趋势，非交换性钾含量呈先升高后降低的趋势；NPK处理的土壤交换性钾含量在水稻生长前期明显升高，中期下降，后期有略微上升，水溶性钾和非交换性钾含量有先升高后降低的变化趋势。综上所述，在不施钾条件下，轮作期内各土壤钾素消耗量较大，水溶性钾和交换性钾含量降低，并促进了非交换性钾的释放；施钾能提高土壤水溶性钾和交换性钾含量，并向非交换性钾方向转化，施钾对黑麦草和水稻有显著增产效果，可以有效地提高土壤供钾水平。

英文摘要:

A pot experiment was carried out using different types of soils to study their potassium (K) supply capacities and K dynamics under a ryegrass-rice rotation system, with a view to providing scientific basis for the research on mechanism of soil supplying K and reasonable K control. Results show that both aboveground biomass and K uptake of the crops in the group without K treatment (NP) were the highest in fluvo-aquic soil (FS), which was followed by yellow cinnamon soil (YCS), then red soil (RS), while in the group with K, fertilization, no significant difference (p>0.05) between the soils was observed in aboveground biomass and a decreasing order of YCS > FS > RS was in terms of K uptake. Treatment NPK was 55.6%, 45.2% and 23.2% higher than treatment NP for red soil, yellow cinnamon soil and fluvo-aquic soil, respectively, in biomass and 368.8%, 166.8% and 74.5%, higher, respectively in K uptake. In the ryegrass growth season, the concentrations of water soluble K and exchangeable K in treatment NP decreased in all the soils. The concentration of non-exchangeable K decreased significantly in fluvo-aquic, but remained almost unchanged in the early season, rose in the middle season and dropped in the late season in yellow cinnamon soil and red soil. Soil K was much higher in treatment NPK than in treatment NP, but varied in a similar pattern in all the three soils, regardless of treatments and K forms. During the rice growing period, in treatment NP, water soluble K in all the soils did not change much soil exchangeable K declined first and then rose, but non-exchangeable K showed a reverse trend, while in treatment NPK, soil exchangeable K rose significantly in the early, and declined in the middle and then turned slightly back again in the late period, whereas soil water soluble K and non-exchangeable K showed a rising and then falling trend. To sum up, In treatment NP, K consumption was higher in all the soils and in all the periods of the rotation, thus decreasing both soil water soluble K and exchangeable K and in turn triggering release of non-exchangeable K. Application of K fertilizer increases the concentrations of water soluble K and exchangeable K and the ratio of K transformed into non-exchangeable K, thus effectively improving K supply capacity of the soil, and eventually increasing the yield of ryegrass and rice significantly.

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