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宁夏中部干旱带砂田抗风蚀性能研究

Wind tunnel test on wind erosion resistance of gravelly farmland in the arid zone of central Ningxia

中文关键词:砂田 净风 挟沙风 风蚀速率 粗糙度 摩阻速度

Key words:Gravel mulch Clean wind Sandy wind Wind erosion rate Aerodynamic roughness length Shear velocity

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中文摘要:

利用风洞模拟实验，研究了净风和挟沙风对砂田土壤风蚀的影响。结果表明：在净风吹蚀下，原状砂田的风蚀速率（0.37 g m^{-2} min^{-1}）分别是农田和荒地的1/4和1/5，风蚀速率随风速的增加呈指数函数递增，其中砂田的递增速度低于农田或荒地；翻耕后的砂田在常见风速下的风蚀速率与农田和荒地相近（分别为1.67 g m^{-2} min^{-1}、1.75 g m^{-2} min^{-1}和1.83 g m^{-2} min^{-1}），但在大风日则低于农田和荒地（分别为3.61 g m^{-2} min^{-1}、58.83 g m^{-2} min^{-1}和13.92 g m^{-2} min^{-1}）。挟砂田沙的风沙流吹蚀导致农田和翻耕砂田的风蚀速率增加，原状砂田则出现轻微的风积现象；挟农田土的风沙流吹蚀使原状砂田、翻耕砂田和荒地产生显著的风积，农田则出现更强烈的风蚀；挟沙风吹蚀下的风蚀（积）速率与风速的关系呈二次曲线函数。砂田的粗糙度明显高于农田(分别为0.023 cm和0.002 cm)，且随着风速的增加，其间的差值越大；砂田和农田在不同风速条件下的风速廓线均可用指数函数表述。农田和荒地在压砂利用后，其抗风蚀和减尘性能显著增强。

英文摘要:

In this study, effects of clean wind and sandy wind on wind erosion of gravelly farmland were simulated in a wind tunnel. Results show that wind erosion rate in virgin gravelly lands (0.37 g m^{-2} min^{-1}) is only 1/4 and 1/5 of that in cropland and wasteland, respectively. Wind erosion rate increased exponentially with wind speed, and the increasing rate is lower in virgin gravelly land than in cropland and wasteland. Once the virgin gravelly land is ploughed, its wind erosion rate is close to those in cropland and wasteland under normal wind speed, being 1.67 g m^{-2} min^{-1}, 1.75 g m^{-2} min^{-1} and 1.83 g m^{-2} min^{-1}, respectively, whereas it is much lower than those in cropland and wasteland under a gale, reaching 3.61 g m^{-2} min^{-1}, 58.83 g m^{-2} $min^{-1}$and 13.92 g m^{-2} min^{-1}, respectively. Wind bearing sands from gravelly land leads to a significant increase in wind erosion rate in cropland and ploughed gravelly land, but light sand deposition in virgin gravelly land, however, wind bearing soil from crop land leads to remarkable soil deposition in virgin gravelly land, ploughed gravelly land and wasteland, but strong erosion in cropland. The wind erosion (deposition) under wind bearing sands shows a relationship of quadratic curve function with wind velocity. Gravelly land is obviously much higher than cropland in aerodynamic roughness length, being 0.023 cm and 0.002 cm, respectively, and the difference widens with wind speed. Wind profiles over gravelly land and cropland varying with wind speed can be described with an exponential function. Apparently, after being mulched with gravels, cropland and wasteland can greatly increase their wind erosion resistance and dust withholding capacity.

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