PERFORMANCE OF LOW PHOSPHORUS TOLERANT BEAN GENOTYPES ON ACIDIC SOILS OF RWANDA

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ABSTRACT

In eastern Africa, bean (*Phaseolus vulgaris* L.) production is highly limited by soil fertility decline, particularly phosphorus (P); yet the typical small-scale farmers are incapable of accessing the often recommended means of replenishing the nutrient stocks. Promotion of use of low phosphorus tolerant bean genotypes is expected to be the sustainable intervention especially among small farmers who are the major producer of beans in the sub-region. Currently, however, such bean genotypes are under pre-dissemination trials at research stations within the region. Moreover, the performance of the materials under the widespread soil related stresses such as high acidity, exacerbated by aluminum toxicity, in east Africa are yet to be investigated. Thus, a greenhouse experiment was conducted at Rubona in Rwanda. The experiment was conducted in plastic pots with 5 kg of soil in each pot, using a highly acidic and P deficient soil collected from Nyamagabe district. The objective of the experiment was to identify superior yielding bean genotypes suitable for such an otherwise unfavorable growth environment. Four low P tolerant genotypes used (G2858 , RWR 1873, RWV 1668; and RWV 1348) and one local check (59/1-2) were used in the initial screening to obtain at least three for the actual treatment part of this study. Overall, the climber bean genotype RWV 1348 had the highest grain yield (6.4 g pot^{-1}) relative to the other climbers and bush genotypes. The two bush bean genotypes RWR 1873 and RWV 1668

had similar grain yields (2.4 and 2.5 g pot^{-1}, respectively). Nodulation efficiency was 73% for RWR 1873, 54% for RWV 1348 and 50% for RWV 1668. In this respect, genotypes RWV1348, RWV 1668 and RWR 1873 were clearly outstanding on the basis of grain yield and nodulation efficiency. The three genotypes were selected advanced for P evaluation, namely 0, 5, and 10 mg kg^{-1} soil as described below. In the second part of the experiment, the thee best yielding low P tolerant genotypes along with 3 levels of P, namely 0, 5 and 10 mg kg^{-1} soil, constituted the treatments, which were laid out in a completely randomized design, with 6 replications. Genotype RWV1348 had the highest grain yield (26.5 g pot^{-1}) and phosphorus efficiency ratio (PER), both occurring at the P rate of 5 mg kg^{-1} soil. The two bush bean genotypes, RWR 1873 and RWV 1668, were P inefficient when the P level reached 10 mg kg^{-1} soil. Phosphorus level of 10 mg kg^{-1} soil promoted shoot production, but suppressed grain yields of the three bean genotypes. Genotype RWR 1873 had the highest nodulation efficiency (73%) under low P conditions, and P level of 10 mg kg^{-1} soil reduced its effective nodulation at 26%. From this study, the low P tolerant bean genotypes perform well under the extreme soil acidity existing in the soils of Rwanda; but their performance improved markedly when externally source P was applied. However, there is need for further field investigations to explain shy application of P above 5 mg kg^{-1} soil suppressed bean yield.