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Arsenate and Phosphate (Pi) uptake by two wheat (*Triticum aestivum* L.) cultivars and their doubled haploid lines

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ABSTRACT

Arsenate, the dominant form of arsenic in aerobic conditions, is taken up by plants via the phosphate (Pi) transport systems because of the chemical similarity between arsenate and Pi. Based on large differences in P uptake in the field, parents (Hanxuan 10 and Lumai 14) and 10 doubled haploid (DH) lines were used to investigate Pi and arsenate uptake over a 48 h period. For each wheat line, Pi and arsenate concentrations in the test solution decreased with uptake time which was fitted well with an exponential (for Pi) or a polynomial (for arsenate) regression. For all genotypes, net Pi-uptake rates always decreased with time (from 0 to 48 h). However, net arsenate-uptake rates decreased with time for D5, and changed little with time for the male parent, D4 and D6, and increased with time for the others. An inflexion of about 25 μM Pi was observed for the relationship between arsenate and Pi concentrations in the test solution, indicating 25 μM could be the point where the high-affinity uptake system 'switches on', or dominates over the low-affinity uptake system(Fig. 1). The ultimate purpose of our study was to identify genotypes, which take up more Pi and less arsenate. The male parent, D1, D6 and D10 were ideal genotypes with Pi transporters

that discriminated better against arsenate and should accumulate less arsenate in the plants (Fig. 2). Further studies are underway to dissect the arsenate uptake and tolerance in this wheat DH population.

Keywords: arsenic, phosphate transporters, ion selectivity, plant membrane transport.

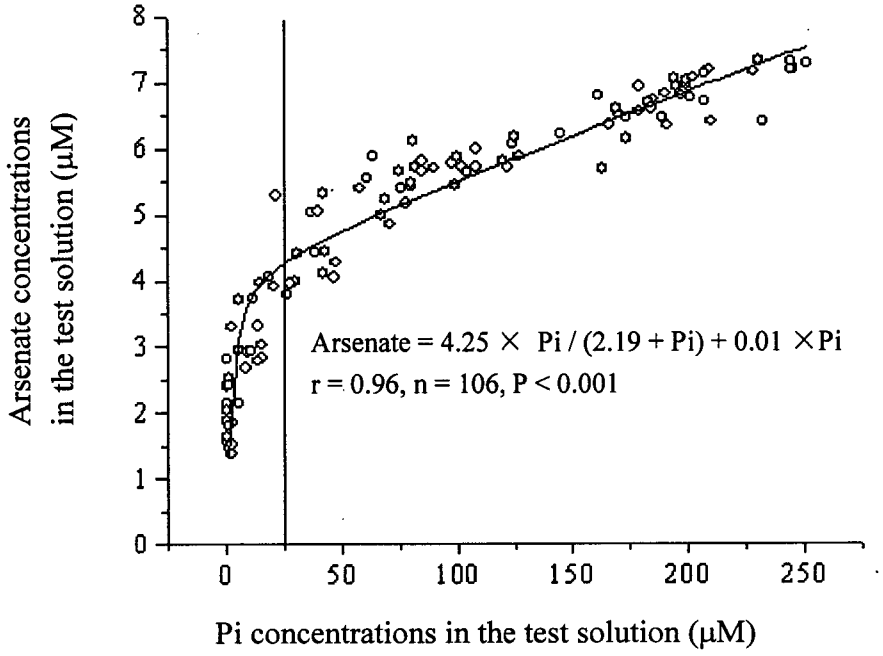

Fig. 1. The relationship between arsenate and Pi concentrations in the test solutions during the 48 h uptake period for parents and 10 doubled haploid lines. Values are from individual replicate of 12 genotypes.

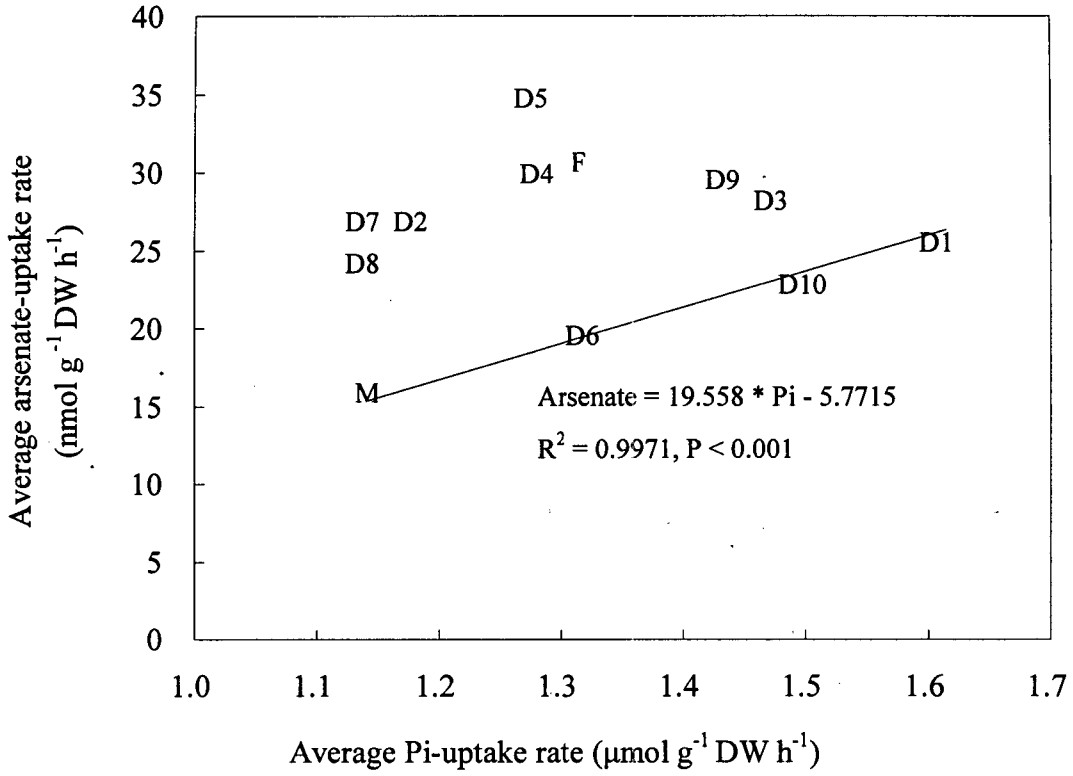

Fig.2. Average Pi and arsenate uptake rates during the 48 h uptake period for parents and 10 doubled haploid lines. Each value was the mean from three replicates with 10 plants for each replicate.