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Genotypic differences in phosphorus acquisition efficiency and root performance of cotton (*Gossypium hirsutum*) under low-phosphorus stress

Bolang Chen, Qinghui Wang, Heike Bücking, Jiandong Sheng, Jia Luo, Zhongping Chai, Arjun Kafle, Yinying Hou and Gu Feng

[A]College of Grassland and Environmental Sciences, Xinjiang Key Laboratory of Soil and Plant Ecological Processes, Xinjiang Agricultural University, Urumqi, Xinjiang 830052, China.

[B]Agricultural Mechanisation Institute, Xinjiang Academy of Agricultural Sciences, Urumqi, Xinjiang 830091, China.

[C]Biology and Microbiology Department, South Dakota State University, Brookings, SD 57007, USA.

[D]College of Resources and Environmental Sciences, China Agricultural University, Beijing 100193, China.

[E]Corresponding author. Email: sjd_2004@126.com; fenggu@cau.edu.cn

Supplementary Table

Table S1.The genetic background of cotton cultivars selected for this study

Sl. No.	Cultivar	Breeding programme	Genetic background
1	Xinhai 6	Institute of Industrial Crops , Xinjiang Academy of Agricultural Sciences	6302/ 4414/ K-173
2	Xinhai 7	Institute of Agricultural Science and Technology of Bayingolin Mongolian Autonomous Prefecture, Korla Xinjiang	6302/ 6904-u
3	Xinhai 13	Institute of Agricultural Sciences and Technology，Agricultural Production Division 1，Xinjiang Production and Construction Corps，Alar Xinjiang	Giza 70/ Xinhai 8
4	Xinhai 14	Institute of Agricultural Sciences and Technology，Agricultural Production Division 1，Xinjiang Production and Construction Corps，Alar Xinjiang	1120/ 44116
5	Xinhai 17	Institute of Agricultural Sciences and Technology，Agricultural Production Division 1，Xinjiang Production and Construction Corps，Alar Xinjiang	Xinhai 8/ Giza75/ Xinhai 10
6	Xinhai 18	Institute of Agricultural Sciences and Technology，Agricultural Production Division 1，Xinjiang Production and Construction Corps，Alar Xinjiang	89- 186/ 88- 38
7	Xinhai 20	Institute of Industrial Crops , Xinjiang Academy of Agricultural Sciences	86430/ 88-346
8	Xinhai 21	Institute of Agricultural Sciences and Technology，Agricultural Production Division 1，Xinjiang Production and Construction Corps，Alar Xinjiang	Xinhai 8× Giza75 *2/ Xinhai 10
9	Xinhai 22	Cotton Institute, Xinjiang Academy Agricultural and Reclamation Science	Xinhai 5/ 784/ 77-18
10	Xinhai 23	Institute of Agricultural Sciences and Technology，Agricultural Production Division 1，Xinjiang Production and Construction Corps，Alar Xinjiang	785-3/XG75
11	Xinhai 37	Institute of Agricultural Sciences and Technology，Agricultural Production Division 1，Xinjiang Production and Construction Corps，Alar Xinjiang	89-79 / 916-493
12	CCRI 10	Institute of Cotton Research, Chinese Academy of Agricultural Sciences	Heishan 1
13	CCRI 35	Institute of Cotton Research, Chinese Academy of Agricultural Sciences	23021/（Zhongmiansuo 12×Chuan 1704）
14	CCRI 42	Institute of Cotton Research, Chinese Academy of Agricultural Sciences	061723/ 916448
15	CCRI 43	Institute of Cotton Research, Chinese Academy of Agricultural Sciences	2230-35/ 321X5716
16	Xinluzao 7	Xinjiang Shihezi Cotton Research Institute	347-2/ Tasigan 2
17	Xinluzao 9	Institute of Agricultural Sciences and Technology，Agricultural Production Division 7，Xinjiang Production and Construction Corps，Alar Xinjiang	Belshinuo/ Zhongmiansuo 17
18	Xinluzao 10	Xinjiang Shihezi Cotton Research Institute	Heishan×02/ 381
19	Xinluzao 12	Liao ning Institute of Economical plant,	Liao 7109/Liao 1038
20	Xinluzao 13	Institute of Agricultural Sciences and Technology，Agricultural Production Division 7，Xinjiang Production and Construction Corps，Alar Xinjiang	83-14/ 5601×1639
21	Xinluzao 16	Institute of Agricultural Sciences and Technology，Agricultural Production Division7，Xinjiang Production and Construction Corps，Alar Xinjiang	Okra/ Belshinuo
22	Xinluzao 17	Institute of Industrial Crops , Xinjiang Academy of Agricultural Sciences	9908
23	Xinluzao 19	Xinjiang Shihezi Cotton Research Institute	91-2/900
24	Xinluzao 21	Shihezi Fuyide Technology Co. Ltd.	1304
25	Xinluzao 23	Xinjiang Gold Jin Cotton Seed Industry	Zhongmiansuo 27
26	Xinluzao 24	Xinjiang Kangdi seed industry	7074/ C-6524
27	Xinluzao 26	Xinjiang Tianhe seed industry	Xinluzao 8
28	Xinluzao 30	Xinjiang gold Bo company	Zhongmiansuo/liaomian
29	Xinluzao 31	Xinjiang Kuitun ten million cotton seed industry company	Xinluzao 6/ Belshinuo
30	Xinluzao 33	Cotton Research Institute，Xinjiang Academy of Agricultural and Reclamation Science	Shixuan87
31	Xinluzao 35	Institute of Agricultural Sciences and Technology，Agricultural Production Division 7，Xinjiang Production and Construction Corps，Alar Xinjiang	(Xinluzao 3×2621)/ 35/97185
32	Xinluzao 36	Xinjiang Shihezi Cotton Research Institute	1304/ BDl03

Supplementary Figures

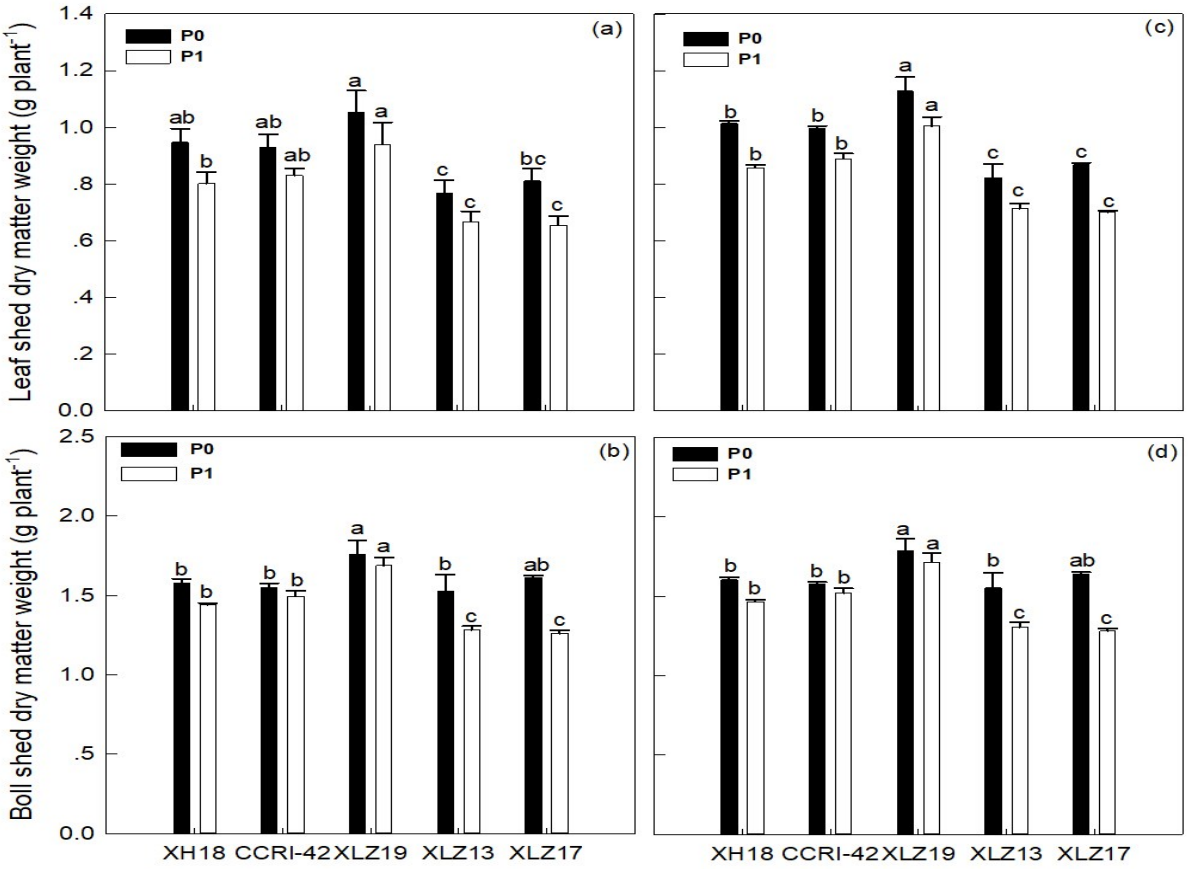

Fig. S1. Differences of biomass in leaf shed and boll shed between the five genotypes at different P treatments in 2014(a, b) and 2015(c, d). Different letters indicate that means are significantly different (Tukey test, $p < 5\%$). The error bars stand for standard error.

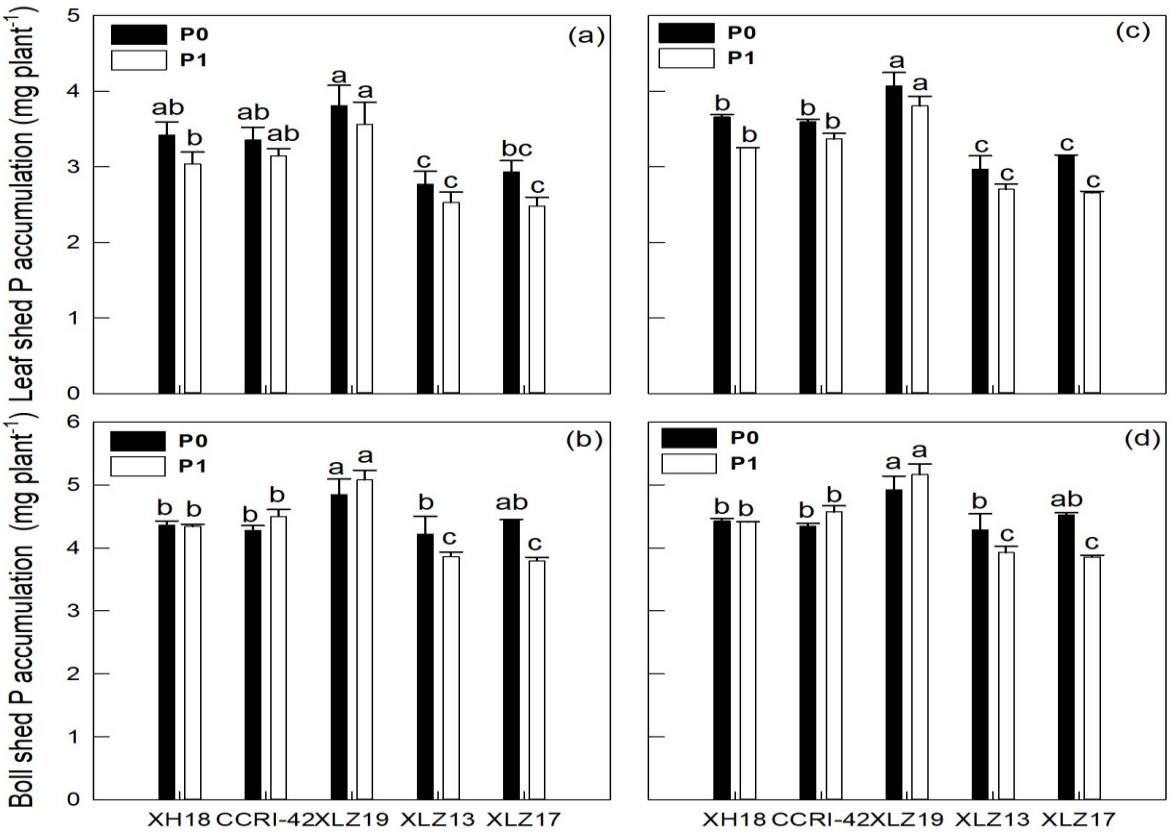

Fig. S2. Differences of P accumulation in leaf shed and boll shed between the five genotypes at different P treatments in 2014(a, b) and 2015(c, d). Different letters indicate that means are significantly different (Tukey test, $p < 5\%$). The error bars stand for standard error.

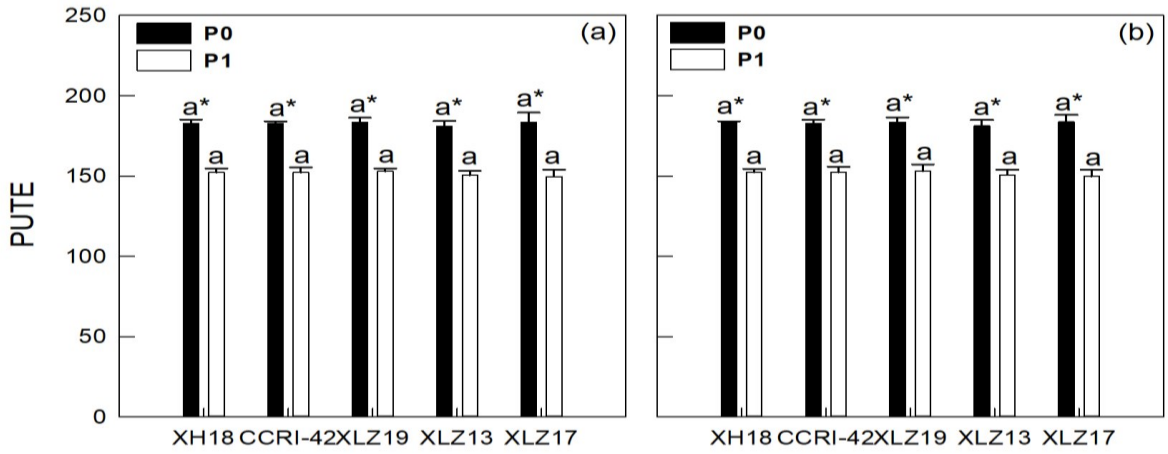

Fig. S3. Differences of phosphorus utilization efficiency (PUTE, kg of boll dry matter produced per kg of P in the plant) between the five genotypes at different P treatments in 2014 (a) and 2015 (b). Different letters indicate that means are significantly different among cotton genotypes (Tukey test, $p < 5\%$). *Indicates significantly different between P0 and P1 treatment. The error bars stand for standard error.

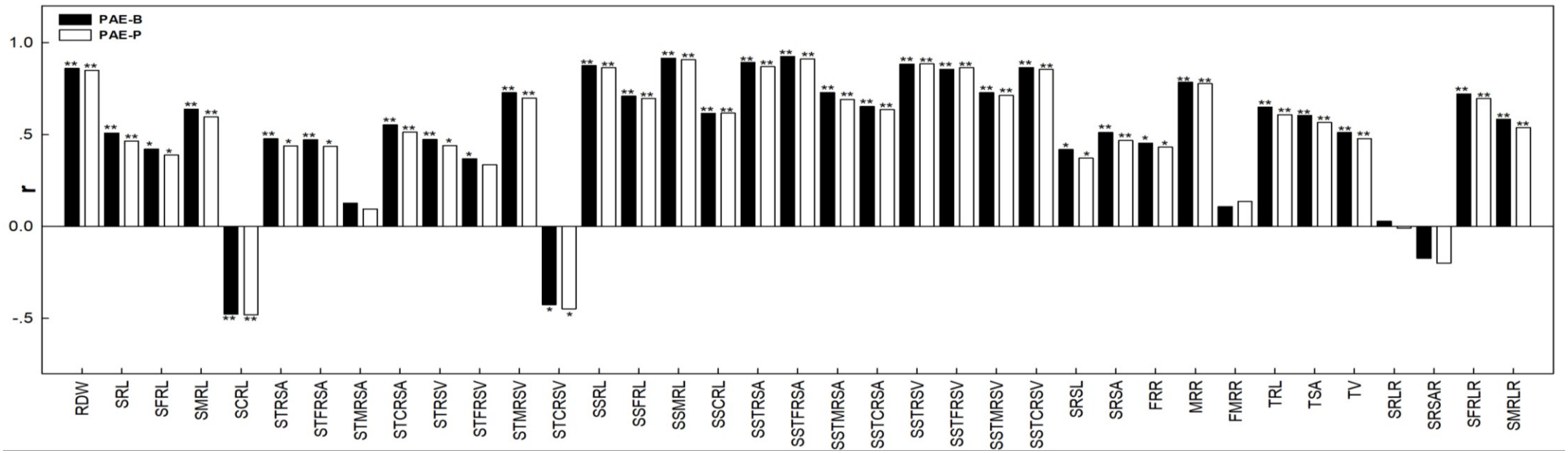

Fig. S4. Correlation coefficients between P-acquisition efficiency and root characteristics at low P level (n=30). PAE-P, P-acquisition efficiency in total plant; PAE-B, P- acquisition efficiency in bolls yield; RDW, root dry weight; SRL, surface root length; SFRL, surface fine root length; SMRL, surface middle root length; SCRL, surface coarse root length; STRSA, surface total root surface area; STFRSA, surface total fine root surface area; STMRSA , surface total middle root surface area; STCRSA , surface total coarse root surface area; STRSV , surface total root surface volume; STFRSV , surface total fine root surface volume; STMRSV , surface total middle root surface volume; STCRSV , surface total coarse root surface volume; SSRL, subsurface root length; SSFRL, subsurface fine root length; SSMRL , subsurface middle root length; SSCRL, subsurface coarse root length; SSTRSA, subsurface total root surface area; SSTFRSA, subsurface total fine root surface area; SSTMRSA , subsurface total middle root surface area; SSTCRSA , subsurface total coarse root surface area; SSTRSV , subsurface total root surface volume; SSTFRSV , subsurface total fine root surface volume; SSTMRSV , subsurface total middle root surface volume; SSTCRSV , subsurface total coarse root surface volume; SRSL, subsurface specific root length; SRSA, subsurface specific root surface area ; FRR , fine root ratio; MRR, middle root ratio; FMRR , fine and middle root ratio; TRL, total root length; TSA, total surface area; TV, total volume; SRLR, surface root length ratio; SRSAR, surface root surface area ratio; SFRLR, surface fine root length ratio; SMRLR, surface middle root length ratio; **, p = significant at 1% level; *, p = significant at 5% level.

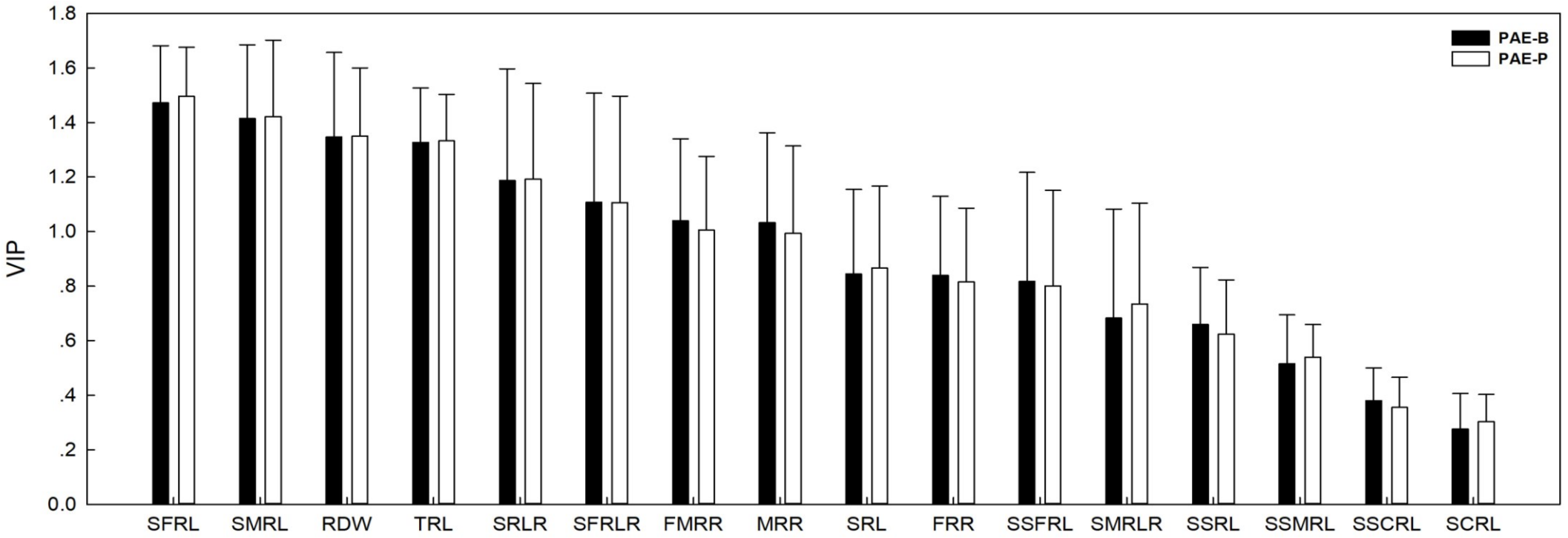

Fig. S5. Partial least squares (PLS) regression for evaluating the variable importance of projection (VIP) between root traits and phosphorus acquisition efficiency (PAE) at low P level (n=30). PAE-P, P-acquisition efficiency in total plant; PAE-B, P- acquisition efficiency in bolls yield; RDW, root dry weight; SRL, surface root length; SFRL, surface fine root length; SMRL, surface middle root length; SCRL, surface coarse root length; SSRL, subsurface root length; SSFRL, subsurface fine root length; SSMRL , subsurface middle root length; SSCRL, subsurface coarse root length; FRR , fine root ratio; MRR, middle root ratio; FMRR , fine and middle root ratio; TRL, total root length; SRLR, surface root length ratio; SFRLR, surface fine root length ratio; SMRLR, surface middle root length ratio.