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An allelic variation controlling a high ratio of four seeds per pod utilized to develop the excellent soybean lines with high yield

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Improving yield is one of the most important goals in soybean (*Glycine max* L. Merr.) breeding. The number of seeds per pod is taken as one of the critical components related to soybean yield. Increasing the number of seeds per pod without reducing seed size is of great significance for enhancing soybean yield potential. In this study, we utilized an allelic variation (a base G mutated to C in GmIn gene) controlling a high ratio of four seeds per pod in total pods per plant identified by Prof. Zhixi Tian's laboratory (JGG, 2013) in soybean molecular breeding for further enhancing the yield potential of soybean cultivars being widely released. On the basis of genome sequencing, we used a suitable soybean donor (Kefeng14 or Heinong40) with a high ratio of four seeds per pod containing the allelic variation of G□C to be hybridized with the widely released soybean variety without allelic variation and phenotype of four seeds per pod (Kedou1 or Zhonghuang13) in the Huang Huai Hai region of China, and then selected some progenies to be backcrossed with a receptor parent (a released variety above) in multiple generations, and screened a number of the elite lines with target phenotype of a high ratio of four seeds per pod and the genotype containing allelic variation with bilateral SNP markers. Finally we developed several new soybean lines such as KH5-2, KZ5-1, KZ5-5, LZ904-1, and LZ904-7 with a high ratio of four seeds per pod and high yield. Among them, KH5-2 and LZ904-7 have shown the highest yields in all new lines and control variety. The field experiment results indicated that the LZ904-7 and KH5-2, which separately increased the ratios of four seeds per pod of 18.55% and 21.47% without reducing their seed sizes compared with control variety, exhibited high yields of 3093.0 kg/ha and 3225.0 kg/ha in display area of 3.3 ha in Henan province, increasing 8.24% and 10.43% compared to that of control variety, respectively. These two excellent lines have participated in both the National Regional Trials and the Provincial Regional Trials.