施氮对高产大豆结实性垂直分布的影响

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摘 要:以亚有限结荚习性大豆吉育60为材料,在田间研究了4种不同施氮量(0、60、120、180 kg·hm^{-2})对单株荚数、粒数、腔数和结实率垂直分布的影响。结果表明:主茎各节的荚数、总荚腔数、粒数增幅因施氮量而异,适宜施氮量处理(120 kg·hm^{-2})15~19节的荚数、总荚腔数和粒数较不施氮对照增幅明显大于10~14节和5~9节,15~19节、10~14节、5~9节的粒数分别增加6.51、1.39、2.06粒,产量(5 264.87 kg·hm^{-2})增加20.22%;各处理的荚空腔数在主茎上由多至少顺序为5~9节>10~14节>15~19节,施氮对荚空腔数的分布影响小、对单株总结实率无影响;施氮明显增加5~13节间长度,并增加基部节间粗度。适量氮肥主要提高了大豆群体上部的结荚能力,从而增加总荚腔数和粒数。

关键词:大豆;施氮量;荚;粒;垂直分布

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Nitrogen Effects Vertical Distribution of Yield Components of High-yield Soybean

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Abstract:Research on the effects of N applications on vertical distribution of soybean [*Glycine max*(L.) Merr.] yield components is limited. Field trials were conducted to determine the effect of N application rate on pods, seeds and cavities number on main stem of soybean, with semi-determinate soybean 'Jiyu60' as material. Nitrogen was applied to the soil with 0, 60, 120 and 180 kg·ha^{-1} at flowering, respectively. Application of N increased pods, seeds and cavities number at any rate and node position. Appropriate N(120 kg·ha^{-1}) significantly increased pods and seeds in 15 - 19, 10 - 14, 5 - 9 nodes of main stem, and increased seed yield by 22% compared with control. The cavities number on different part of stem were lower (5 - 9 node) > middle(10 - 14) > upper section(15 - 19 node), application of N had less influence on the distribution of empty pod cavities and had no influence on total seed-setting rate. Nitrogen increased stem diameter of basal node and internode length between 5th and 19th node. Appropriate N enhanced the pod-setting ability of upper section of soybean population, hence, increased total number of cavities and seeds number.

Key words:Soybean; Nitrogen rate; Pod; Seed; Vertical distribution

大豆是节上结实的"全身结荚"作物,各个节位叶片和荚都构成一个"源-库"系统[1]。单株荚数和粒数是影响大豆产量的主要因素。大豆荚、粒在茎秆上的垂直分布与产量形成密切相关[2-5]。大豆结实性状又受到株型结构的影响[6]。合理施用氮肥是大豆最重要的增产措施之一。有关施氮肥对大豆产量的影响,前人做了大量研究工作,这些研究多集中在施氮对结瘤、叶面积动态、干物质积累、养分积累等方面[7-10],而有关施氮肥对结实性垂直分布的影响鲜有报道。该文研究了施氮量对高产春大豆荚数、粒数、空腔数等荚垂直分布的影响,为大豆理想株型设计及产量突破提供理论依据。

1 材料与方法

1.1 试验设计

试验于2010年在新疆伊犁地区伊宁县吉里于孜镇进行。供试材料为亚有限结荚习性大豆品种吉育60。试验地土壤为壤土,有机质15.96 g·kg^{-1}、速效氮36 mg·kg^{-1}、速效磷7.2 mg·kg^{-1}、速效钾92 mg·kg^{-1}。翻地前施入540 kg·hm^{-2}磷酸二铵和277 kg·hm^{-2}硫酸钾。试验设0 kg·hm^{-2}(对照N_0)、60 kg·hm^{-2}(N_{60})、120 kg·hm^{-2}(N_{120})、180 kg·hm^{-2}(N_{180})4个不同施氮量(开花期纯氮)处理,3次重复,田间按随机区组

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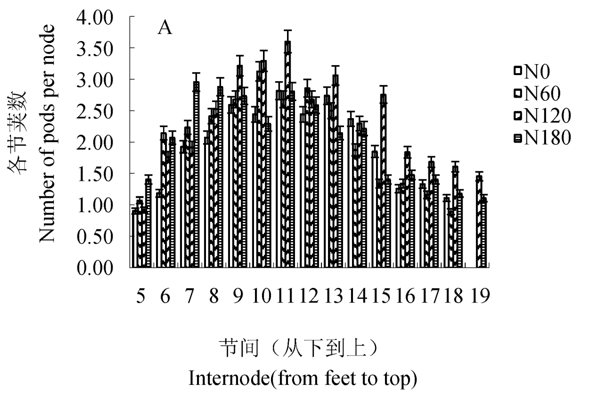

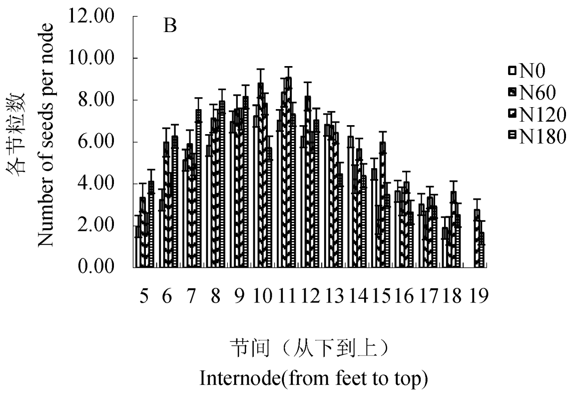

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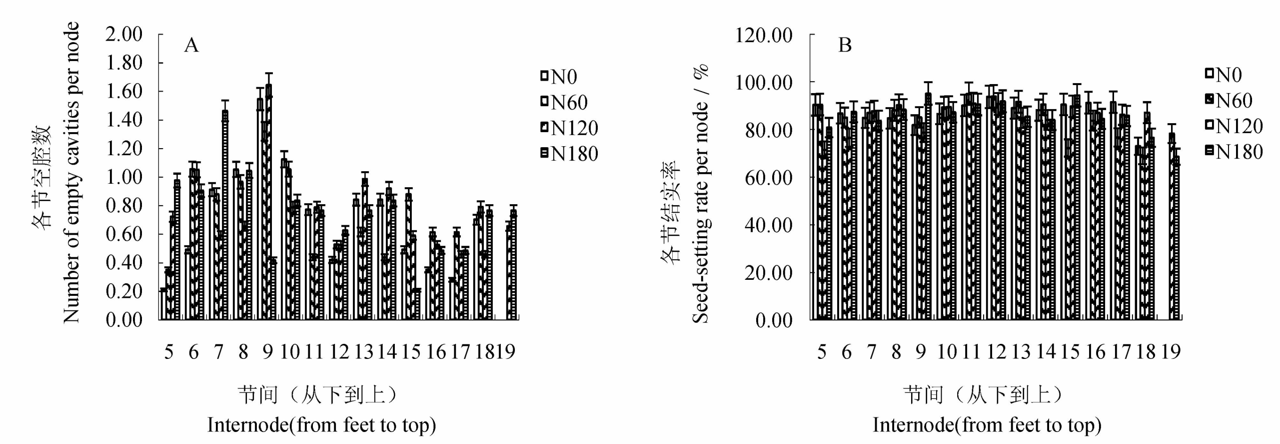

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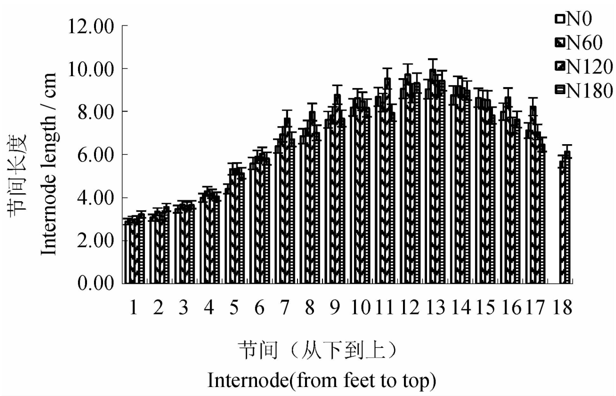

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数，增加了大豆全生育期的干物质积累量[11]。单株荚数和粒数的差异往往是造成大豆产量差异的主要原因。由于各节位叶片和荚构成一个“源 – 库”系统。主茎各节的荚数是由成花数与成荚率乘积所决定的。主茎不同节位的叶、花、荚、粒同各器官大体按自下而上的先后顺序形成,各节的成花数主要是受下部相邻节叶片光合物质生产的影响,各节的成荚率则主要决定于结荚期间对应节位叶片的光合物质生产状况。因此,成熟时主茎上粒数和荚数的垂直分布是花、叶、荚、粒分布与光合物质生产垂直分布动态变化相互作用的最终结果。单株荚数和粒数受到株型结构的影响,大豆不同植株不同层次叶、荚、粒的对应关系和籽粒产量空间分布与高产密切相关[2-3],荚、粒垂直分布受到植株田间密度的影响[4]。通过不同大豆品系比较认为,提高中上部尤其是顶端的荚数、腔数和下部的结实率是提高大豆产量重要途径[5]。王连铮[12]认为大豆的超高产株型结构为结荚上下均匀,每节荚数多,顶部荚数多。该试验结果表明,合理施氮能增加主茎各节的荚数和粒数,并且 15 ~ 19 节的粒数和荚腔数增幅远大于 10 ~ 14 节和 5 ~ 9 节。增加单位面积上的荚腔数是施氮增产的主要原因。施氮同时增加 5 ~ 13 节间长度,导致株高和基部节间茎粗增加。可见,合理施氮增产主要在于提高群体上部粒数,但同时又增加了主茎中、上部的节间长度,增加株高,使植株重心上移,这些植株性状的变化易使植株发生倒伏。如何协调增加群体上部粒数(发挥群体上部的光合物质生产潜力)与倒伏之间的矛盾,是进一步提高晚熟春大豆产量需要研究的问题。

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