



Study on the mathematical model of the effects of NPK on winter cauliflower

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ABSTRACT

In order to study the effects of nitrogen (N), phosphorus (P) and potassium (K) on the yield, the appearance eligibility ratio and the contents of total glucosinolates and glucoraphanin of cauliflower, the 311-A optimization regression design was used to conduct field experiments of N, P, K fertilizer treatments using winter cauliflower variety “HB16”. The models of the balanced application for N, P and K fertilizers were set up. According to the different production targets, the different optimal combinations of applying NPK fertilizers could be carried out. The results showed that the optimal combination of applying fertilizer was 372.83 kg/hm² N, 89.65 kg/hm² P₂O₅ and 201.41 kg/hm² K₂O, the highest yield was 19089.25 kg/hm². When the optimal combination of applying fertilizers was 434.20 kg/hm² N, 90.11 kg/hm² P₂O₅, 213.92 kg/hm² K₂O, the eligibility products ratio could reach the highest at 84.95%. It was found that there were significant effects on the contents of total glucosinolates and glucoraphanin by applying N fertilizer, but not by P and K fertilizers. When N fertilizer application reached 408.78 kg/hm² and 394.62 kg/hm², total glucosinolates and glucoraphanin content would get to maximum, respectively.

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1. Introduction

Cauliflower (*Brassica oleracea* var. *botrytis*) is an important field vegetable in China. Nitrogen (N), phosphorus (P) and potassium (K) were vital factors which affected the yield and quality of cauliflower. It has been shown that increasing N, K fertilizer application could increase cauliflower yield [1–4]. However overcommitting fertilizer would reduce yield and bring negative effect on soil. Developing scientific fertilizer effect function is the base of prescribing fertilizer recommendations for cauliflower.

In the past, lots of research have been done on yield response models for balanced fertilization in various arable crops [5,6], but relatively little work on this subject has been done for field vegetables including cauliflower. These different forms of fertilizer response models reflect the relations between fertilizer rates and yield or quality [7,8]. Fertilizer response function could be obtained by multi-factor quadrature, regression design method, etc. In the method of regression design, based on the multiple levels experimental design, the yield of different treatments was statistically analyzed, the function relation between fertilizer and yield could be set up [9]. According to the functional equation, the single and interaction effects of NPK could be directly deduced, and the appropriate fertilization recommendations with optimum fertilizer rate and optimum NPK proportion could be obtained. In addition, the yield, quality and profit could be analyzed by means of marginal effect [10,11].

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