

Growth Characteristics of Nursery Plants Regenerated Through in vitro Culture in Leek (*Allium porrum* L.)

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The growth characteristics of leek (*Allium porrum* L.), regenerated through in vitro culture, were investigated. Leaf sprouts emerged from the ground 2 to 4 weeks after planting in the field. Adult foliage followed, and four to five leaves were produced by December. The following April the foliage began to elongate and the plant height increased. By July the leaves had completely expanded and bolting and flowering followed. The number of bulbs per plant at harvest was 6.2 in the control. However, they varied from 2.9 to 9.7 among the 29 lines under investigation. The fresh weight of bulbs per plant also ranged from 3.8 to 25.3 g. The relationship of the fresh weight of the bulbs between planting in 1995 and harvesting in 1996 was shown to be significantly positive ($r = 0.86$) and was also consistently stable. These results provide significant information on growth characteristics of plants regenerated through in vitro culture, and indicate that an individual selection by numbers and fresh weight of bulbs as an index, will increase the efficiency of cultivation.

INTRODUCTION

Leek (*Allium porrum* L.) is a vegetable crop grown for its edible bulbs and belongs to the *Allium* family, i.e. onion (*A. cepa* L.) and garlic (*A. sativum* L.). Recently, in vitro culture has been considered to be a useful method for the improvement of crop characteristics in *Allium* (Keller, 1990; Nomura and Makara, 1993; Mohamed-Yasseen et al., 1994). Regeneration through in vitro culture has been described for leeks (Schavemaker and Jacobsen, 1995; Silvertand et al., 1995) and is a valuable new propagation method as well as the traditional seed and vegetative methods. Plants produced by tissue culture are useful for a breeding programme aimed at improving yield and quality. It is important to specify the desirable characteristics of plants for commercial cultivation.

In this report, the growth characteristics of leeks which were regenerated in vitro were investigated.

MATERIALS AND METHODS

The plants from which the material for in vitro culture was taken were used as the

control in this experiment. The tissue-cultured plants were divided into 29 groups and their fresh weight was individually measured. Five to seven bulbs of each group were transplanted into the field at the experimental farm of Iwate University in October 1995. After transplanting, all of the bulbs were observed to grow in the field. In August 1996, when the foliage began to die, the bulbs were collected. After harvesting, the number and fresh weight of bulbs were recorded for each group.

RESULTS AND DISCUSSION

Young leaves were observed to emerge above the ground 4 weeks after planting out. Adult foliage followed and gradually increased to between four or five leaves by December. However, after December no new leaves emerged. In the following April, leaves elongated and the height increased (Fig. 1). From June to July, the leaves expanded further and bolting commenced. The flower stalk with involucre began to elongate through the leaf sheaths. The involucre grew with the elongation of the flower stalk. Flowering occurred from top to bottom of the umbel-shaped inflorescence when the involucre was removed.

Leek seedlings grown from seed sown in spring do not produce bulbs until the seedlings have matured. The bulbs begin to grow once temperatures drop in winter (Yakuwa, 1963; Aoba, 1976). When the bulbs are transplanted, they can be propagated vegetatively. Therefore, it is necessary to find the best producing plants in the field for commercial purposes. In this experiment, all of the tissue-cultured bulbs and the mother plants sprouted and developed into plants. The leaf colour of both types of plants was similar.

Significant differences in the number of bulbs occurred among the 29 groups (Fig.



Figure 1. Development of leek plants regenerated through *in vitro* culture.

2). There were 6.2 bulbs harvested from the control. More than half of the groups had 5 to 8 bulbs but the numbers in groups 3, 17, and 18 were lower, 2.9-3.0., while groups 12, 23 and 26 had more than eight bulbs and were considered superior to the other groups. Thus, the numbers of bulbs varied from 2.9 to 9.7 among the 29 groups of plants.

The fresh weight of bulbs per plant was closely related to the number produced

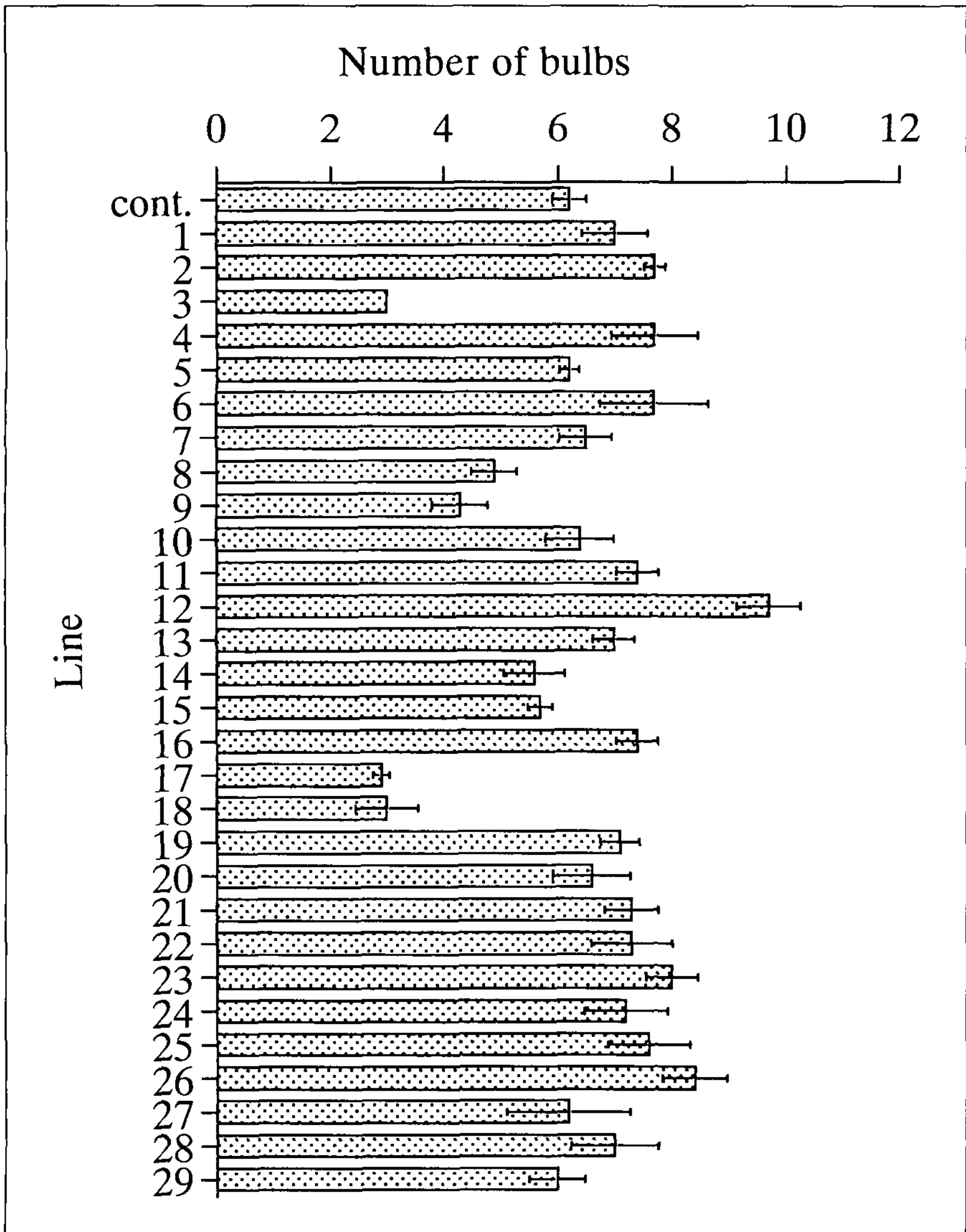


Figure 2. Comparison of the number of bulbs from leek plants regenerated in vitro. Vertical bars indicate S. E.

(Fig. 3). Group 3 had the highest fresh weight of bulbs, 25.3 g. However, the number was small compared with other groups, while group 12 had the lowest fresh weight, 3.8 g.

In leeks, leaf-bud formation occurs at the basal plates when the bulbs are subjected to low temperatures after flower-bud formation. The leaf-bud grows gradually as the temperature increases to develop the mature bulb (Yakuwa, 1963). The process of leaf-bud formation is also similar to that of garlic. However, the leaf-bud formation

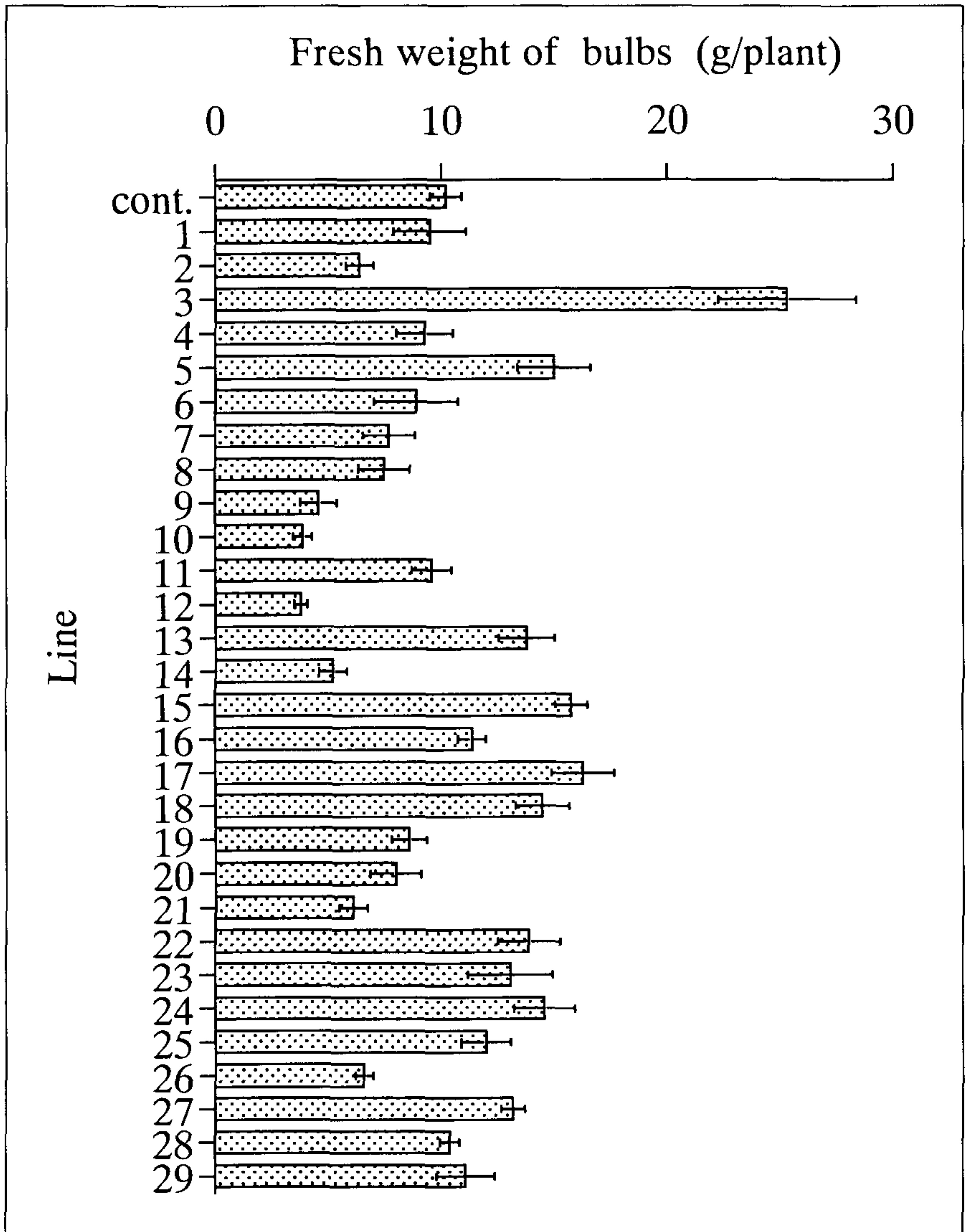


Figure 3. Comparison of the fresh weight of bulbs among leek plants regenerated in vitro. Vertical bars indicate S. E.

and the numbers of buds are different from those of garlic. Results indicate that the differences in the number and fresh weight of the bulbs are useful criteria for selection.

The relationship of the fresh weight of the bulbs between planting in 1995 and harvesting in 1996 was significantly positive ($r = 0.86$) (Fig. 4). This characteristic was recognized to be constantly stable in both 1995 and 1996. The plants regenerated in vitro proved to have significant differences in some growth characteristics.

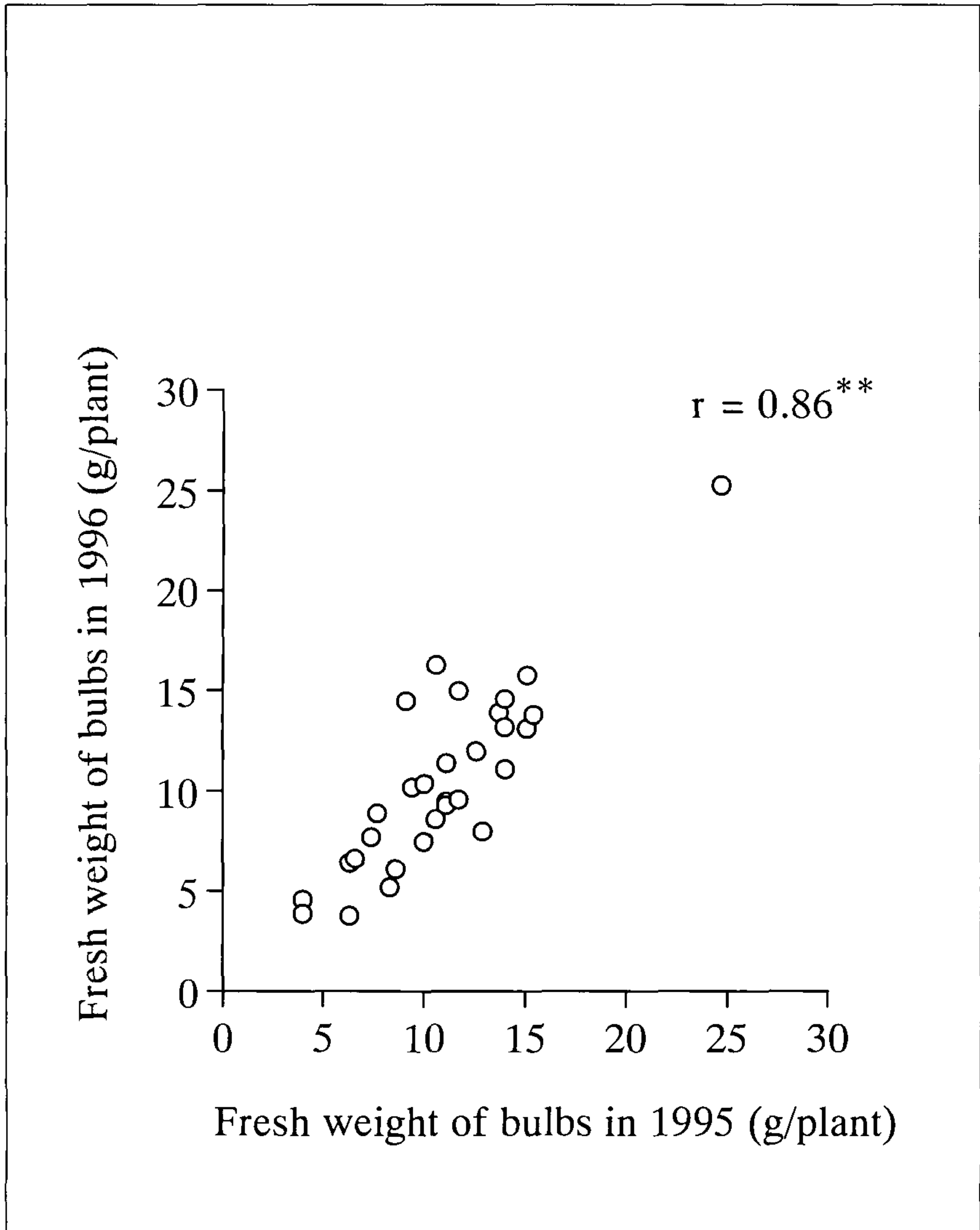


Figure 4. Relationship of the fresh weight of bulbs in 1995 and 1996 among leek plants regenerated in vitro. ** Significant at 1% level.

These results provide significant information on the growth characteristics of leek plants regenerated in vitro. It is shown that individual selection by numbers of bulbs and fresh weight of bulbs as an index, increases the efficiency of cultivation.

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