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Vegetative and Floral Traits of Iris Improved by Altered NPK Doses

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Authors' contributions

This work was carried out in collaboration between all authors. Author SR envisioned the project and conducted the experiment. Author IH provided guideline and supervised the project. Author SM helped in conduction of the experiment and managed the literature search. All authors read and approved the final manuscript.

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ABSTRACT

Iris is very important among cut flowers and has wide range of colours. Thus, production of Iris cut flower on commercial basis can be a good income source for farmers. This study was carried out at the experimental area of Department of Horticulture, PMAS Arid Agriculture University, Rawalpindi to discover the effect of diverse nutritional levels of NPK fertilizers i.e. T_0 (control), T_1 (3.0 N, 6.0 P and 3.0 K g/m²), T_2 (6.0 N, 12.0 P and 6.0K g/m^2) and T_3 (12.0 N, 24.0 P and 12.0 K g/m^2) for exploring the optimum performance of three Iris cut flower cultivars. Results of the study revealed that on average vegetative and floral traits were best with T_1 (3.0 N, 6.0 P and 3.0 K g/m^2). Tallest plants, maximum leaf area, maximum numbers of flowers, maximum spike length, maximum size of flowers, maximum fresh and dry weight of flowers were noted from T_1 (3.0 N, 6.0 P and 3.0 K g/m^2). Whereas, lowest performance of cut flower was noticed under treatment T_0.

Keywords: Cultivars; fertilizer; floret size; iris; number of flowers per spike.

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1. INTRODUCTION

Cut flowers is one of the largest industry in the world with an annual worth of US $ 50 billion. Pakistan is earning US $ 126 million from foreign exchange with an annual production of 10-12 tons of flowers [1]. Flower industry can be expanded by improving the standards of floriculture products [2]. Nature has blessed Pakistan with ideal climate and geographical location for flowers production. It can be a profitable business for small farmers with minimum cost [3].

Iris (*Iris hollandica*) is an important cut flower of family Iridaceae. Among the fall bulbs, the Dutch Iris has the worth like a prince due to its perfect three large petals and showy-flowers. Iris has been used in gardens and parks as ornamental plant since ancient times due to its beautiful and multi coloured flowers [4]. More than 300 species of iris have been distributed naturally in the Northern Hemisphere [5].

The role of nutrient management is vital among the numerous factors affecting the growth, development and quality characteristics of plants. Proper nutrients improved the growth, development, and health of plants by providing resistance against insects, pests and diseases. Thus, great attention is required to apply suitable quality of nutrients via appropriate nutrient sources [6]. Nitrogen (N), phosphorus (P) and potassium (K) are the basic nutrient elements which played a chief role in flower quality and production [7]. Parveen et al. [8] and Ali et al. [2] reported that application of NPK has significantly affected the vegetative, reproductive and qualitative traits in Iris and Tulip flower, respectively.

Nitrogen is essential for biomass creation and biosynthesis of enzymes in the leaves [9]. It increased the vegetative growth and quality of foliage by promoting carbohydrates synthesis. Plants dry matter comprises of 7% Nitrogen and is a constituent of various vital cell components [10]. Phosphorus constitutes about 0.2% dry weight of plants and is important for root growth. It is also a vital constituent of energy molecules (AMP, ADP and ATP), nucleic acids (DNA and RNA), and phospholipids [11,12]. Potassium is an important constitute for photosynthetic activity in leaf and helps in food translocation [13]. Hence, this study was carried out with the aim of exploring the best dosage of NPK fertilizer for Iris cut flower production.

2. MATERIALS AND METHODS

The present research was carried out at the experimental area of Department of Horticulture, PMAS-Arid Agriculture University Rawalpindi. Interaction of three Dutch Iris cultivars (Wedge Wood, Prof. Blaauw and Pride of Holland) and three nutritional levels of NPK fertilizers i.e. T_1 (3.0 N, 6.0 P and 3.0 K g/m²), T_2 (6.0 N, 12.0 P and 6.0K g/m^2) and T_3 (12.0 N, 24.0 P and 12.0 K g/m^2) as compared to T_0 (control: where no fertilizer was applied) were studied to explore the optimal performance. The seeds / bulbs of Dutch Iris were purchased from well reputed seed supplier. Bulbs sowing was done in the month of November and harvesting in May. The crop was ready to harvest in 5-6 months. Before plantation, experimental land was prepared thoroughly. Experiment was laid out in field with RCBD having two factorial arrangements replicated four times. There were 12 plots in each replication, each plot size was 40.5 sq. ft. along with 3 rows. The planting distance was 30 × 45 cm. Fertilizers were used in the form of urea, triple super phosphate and potash. Farmyard manure @ 20 ton/ ha was applied at the time of field preparation. Nitrogen was applied in two split doses, while phosphorus and potassium were applied at one time. Cultural practices like weeding, hoeing and irrigation was done fortnightly. The data was noted for plant height, leaf area, number of florets/spike, spike length, flower size, flower fresh and dry weight on randomly selected plants from each plot of the experiment. The collected data was analyzed statistically with MSTAT-C software program as suggested by Gomez and Gomez [14].

3. RESULTS AND DISCUSSION

Plants of three Dutch Iris cultivars; Wedge Wood (V_1), Prof. Blaauw (V_2) and Pride of Holland (V_3) were grown in the field condition against different doses of NPK fertilizers. Observations were noted for differences in plant height, leaf area, number of florets/spike, spike length, flower size, and flowers fresh and dry weight. Vegetative traits like plant height and leaf area were found significant for cultivars and doses of NPK fertilizers (Fig. 1). Tallest plants were produced by T_1 (3.0 N, 6.0 P and 3.0 K g/m²), while the minimum plant height (42.78 cm) was observed by T_0 (control). Among cultivars Pride of Holland (V_3) showed maximum plant height of 55.58 cm and minimum plant height of 34.51cm was observed by Prof. Blaauw (V_2). Interaction among cultivars and NPK treatments was

significant for plant height. Cv. Pride of Holland (V_3) showed highest plant height of 61.40 cm with T_1 (3.0 N, 6.0 P and 3.0 K g/m²), while minimum plant height of 30.29 cm was observed by cv. Prof. Blaauw (V_2) with control plot (T_0). Maximum leaf area of 67.63 cm^2 was obtained under treatment T_1 (3.0N, 6.0P and 3.0K g/m²), whereas the minimum leaf area of 46.01 cm^2 was recorded in control treatment (T_0). Among cultivars, maximum (104.3 cm^2) and minimum (30.17 cm^2) leaf area was observed in V_1 (Wedge Wood) and V_3 (Pride of Holland), respectively. Significant differences were observed among cultivars and NPK treatments. Maximum leaf area (119.9 cm^2) was observed in V_1 (Wedge Wood) with T_1 (3.0N, 6.0P and 3.0K g/m²). While minimum leaf area (24.92 cm^2) was observed in V_3 (Pride of Holland) under control treatment (T_0). The results of present study are similar to those of Parveen et al. [8] and Bashir et al. [15] in Iris and Gladiolus, respectively. Genetic makeup might be the cause of difference in plant height and leaf area of cultivars [16]. Increased in plant height and leaf area might be the cause of nitrogen effect as Nitrogen is believed to be the peak critical importance being component of protein, enzymes, vitamins, nucleic acid and chlorophyll which are helpful in plant growth and development [17].

Floral traits were found significant for cultivars and NPK treatments (Fig. 2). Maximum number of florets (2.542) were obtained under treatment T_1 (3.0N, 6.0P and 3.0K g/m²), whereas minimum number of florets (1.438) were observed from control (T_0). Among cultivars, cv. Pride of Holland (V_3) showed maximum number of florets/spike (2.953), while minimum number of florets/spike (1.563) was observed by V_1 (Wedge Wood) and V_2 (Prof. Blaauw). Interaction among cultivars and NPK treatments were also found significant for number of florets/spike. Cv. Pride of Holland (V_3) showed highest number of florets/spike (3.625) under T_1 (3.0N, 6.0P and 3.0K g/m²), while, minimum number of florets/spike (1.125) were observed by V_1 (Wedge Wood) and V_2 (Prof. Blaauw) in control (T_0). Maximum spike length (34.71 cm) was recorded under T_1 treatment where NPK was applied at the rate of 3.0N, 6.0P and 3.0K g/m² respectively, whereas, the minimum spike length (28.91 cm) was observed under T_3 where highest dose of the NPK of this study was applied (10N, 20P and 10K g/m²). Among cultivars, maximum spike length (37.75 cm) was observed in cv. Pride of Holland (V_3), while minimum spike length (24.31 cm) was observed in cv. Prof. Blaauw (V_2). Interaction among cultivars and NPK treatments showed that cv. Pride of Holland (V_3) has longest spike length (41.40 cm) with T_2 (6.0N, 12P and 6.0K g/m²) while, minimum spike length (23.75 cm) was observed in cv. Prof. Blaauw (V_2) with control plots (T_0). Our results are in close agreement of Bashir et al. [15] and Sowmya and Prasad [6] in Gladiolus and China aster, respectively. Genetic makeup might be the cause of difference in floral traits [18]. Foliar nutrition with NPK in addition to soil application significantly affects vegetative growth and floral characters [15]. Thus, it is essential to provide a suitable combination of nitrogen, phosphorus, and potash in a careful manner to attain the optimal vegetative and floral growth [19].

Floral quality found significant for cultivars and NPK treatments (Fig. 3). Maximum flower size of 33.74 cm was observed from T_1 (3.0N, 6.0P and 3.0K g/m²), whereas the minimum flower size (22.28 cm) was observed under control treatment T_0. Among cultivars, maximum flower size (33.41 cm) was observed in Wedge Wood (V_1), while cv. Prof. Blaauw (V_2) showed minimum flower size (24.58 cm). Interaction among cultivars and NPK treatments was also found significant for flower size. Cv. Wedge Wood (V_1) showed maximum flower size (37.56 cm) with T_1 (3.0N, 6.0P, 3.0K g/m^2) while minimum flower size (18.83 cm) was observed in V_2 (Prof. Blaauw) cultivar under T_0 (control). Similarly, Ramzan et al. [20] found maximum flower size of 36.65 cm in Iris cultivar Wedge Wood when treated with salicylic acid @ 1 mM/L. Flower fresh weight was found significant for cultivars and NPK treatments. Maximum flower fresh weight (8.04 g) was obtained from T_1 (3.0N, 6.0P, 3.0K g/m²), whereas the minimum flower fresh weight (5.90 g) was observed under control plots (T_0). Among cultivars, maximum flower fresh weight (7.40 g) was observed by Wedge Wood (V_1), while Prof. Blaauw (V_2) showed minimum flower fresh weight (6.88 g). Interaction among cultivars and NPK treatments was also found significant for flower fresh weight. Maximum flower fresh weight (8.26 g) was recorded in Wedge Wood (V_1) with T_1 (3.0N, 6.0P, 3.0K g/m²), while minimum flower fresh weight (5.32 g) was recorded from Prof. Blaauw (V_2) with control plots (T_0). Flowers Dry weight was found significant for cultivars and NPK treatments. Maximum flower dry weight (0.87 g) was obtained with T_1 (3.0N, 6.0P, 3.0K g/m²), whereas minimum dry weight (0.45 g) was achieved from control plots (T_0). Among cultivars, Wedge Wood (V_1) showed maximum flower dry weight (0.75 g) while minimum dry weight (0.62

g) was observed form (V_2). Interaction among cultivars and NPK treatments showed that cv. Wedge Wood (V_1) gave maximum flower dry weight (0.95 g) under T_1 (3.0N, 6.0P, 3.0K g/m²),while, minimum flower dry weight (0.37 g) was observed in cv. Prof. Blaauw (V_2) from control plots (T_0). Our results are in complete accordance with the results of Lehri et al. [21] and Sowmya and Prasad [6] in Gladiolus and China aster, respectively. Difference in genetic make-up might be the cause of variation in floral quality traits [18]. This might be the effect of Phosphorus role in enhancing flower fresh and dry weights in feverfew (*Tanacetum parthenium*) [12]. Chemical fertilizers are involved in several plant development processes and promote a number of desirable features including uniform flowering, reduced time to flowering, and increased flower number and size. Nitrogen enhances the vegetative growth and in combination with phosphorus increased the flower size [21]. Foliar nutrition with NPK in addition to soil application significantly affects vegetative growth and floral characters [15]. Thus, it is essential to provide a suitable combination of nitrogen, phosphorus, and potash in a careful manner to attain the optimal vegetative and floral growth [19].

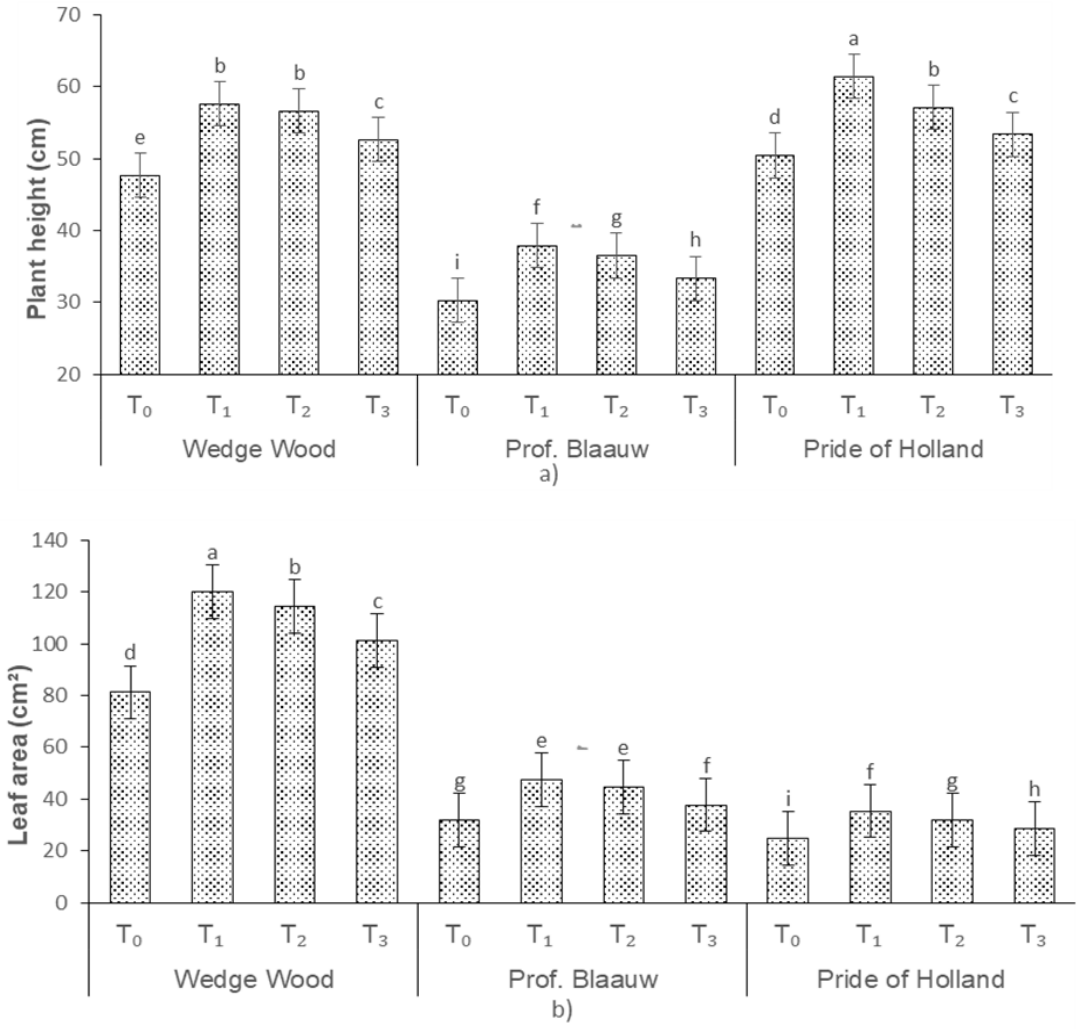


Fig. 1. Interactive effect on Iris and NPK treatments on a) plant height and b) leaf area. Vertical bars indicate ± SE of means. n = 3 replicate. Any two means not sharing same letter differ significantly at 5% level of probability

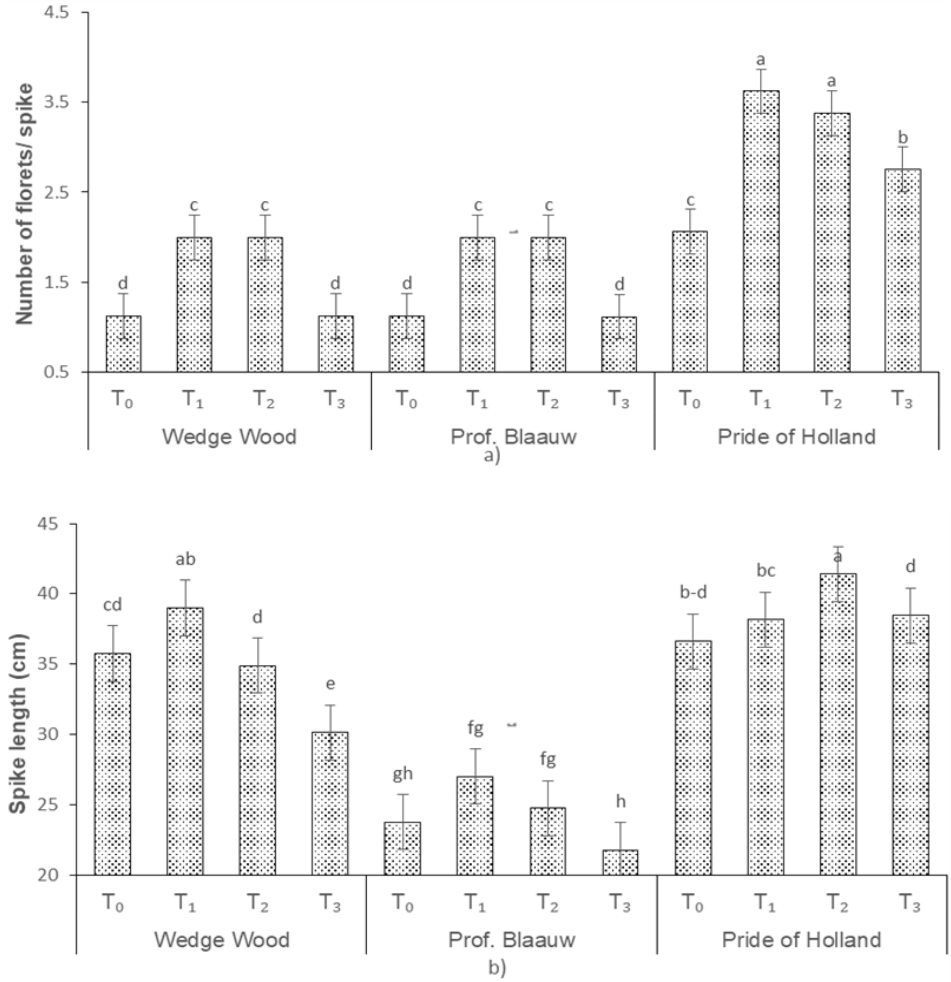
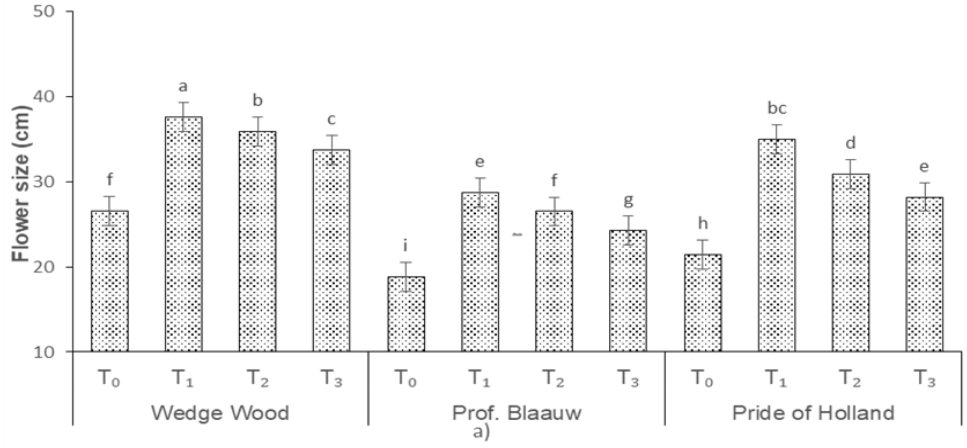


Fig. 2. Interactive effect on Iris and NPK treatments on a) number of florets per spike and b) spike length. Vertical bars indicate ± SE of means. n = 3 replicate. Any two means not sharing same letter differ significantly at 5% level of probability



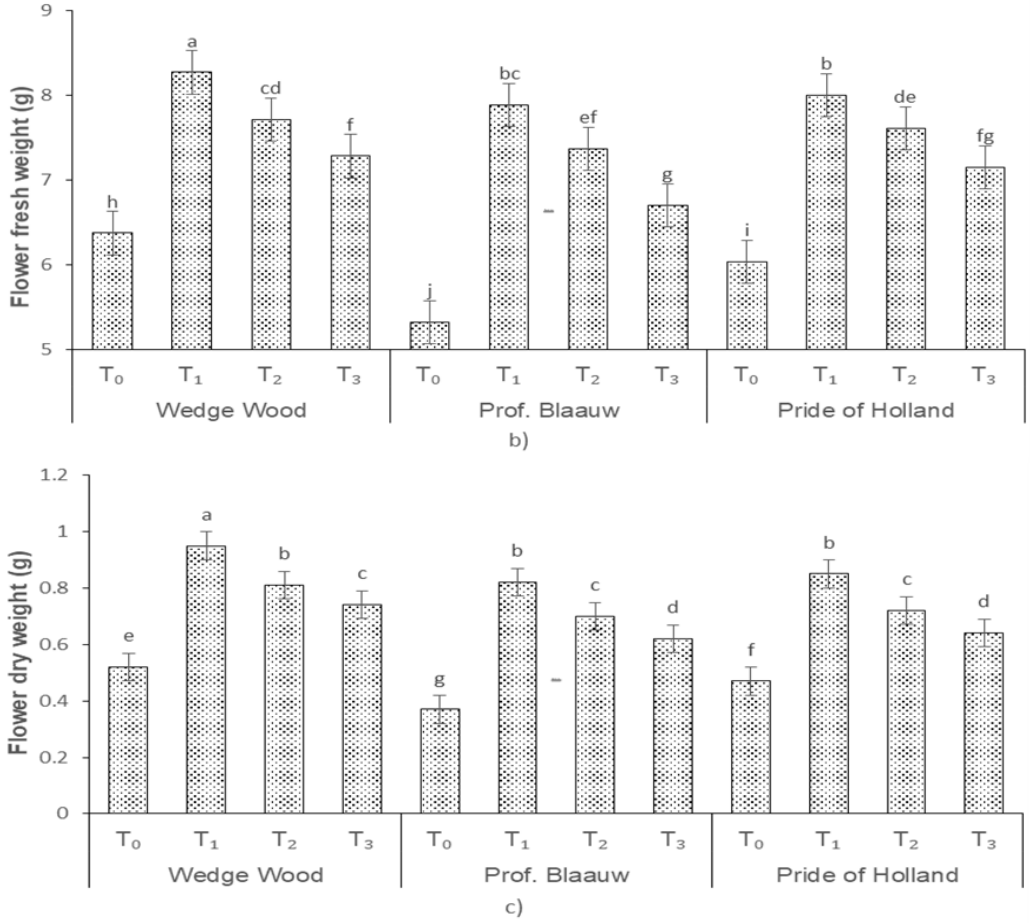


Fig. 3. Interactive effect on Iris and NPK treatments on a) flower size (cm) b) flower fresh weight (g) and c) flower dry weight (g). Vertical bars indicate ± SE of means. n = 3 replicate. Any two means not sharing same letter differ significantly at 5% level of probability

4. CONCLUSION

Wedge Wood cultivar is recommended for semi-arid regions. Vegetative and floral traits of Dutch Iris showed best performance with fertilizer combination of T_1 (3.0N, 6.0P, 3.0K g/m²).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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