

EFFECT OF PHOSPHORUS FERTILIZER APPLICATION ON FODDER AND GRAIN YIELD OF VETCH UNDER RAINFED CONDITIONS OF POTHOWAR REGION

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The study was conducted to optimize fertilizer dose in Vetch (*Vicia sativa*) for higher fodder yield and grain yield under rainfed conditions at National Agricultural Research Centre, Islamabad during 2001-02 to 2002-03. The experiment was laid out in randomized complete block design with three replications, keeping plot size 3m x 1.6m. Vetch was sown on Mid. October 2002 and Mid October 2003 in the pattern of 60 cm apart in rows. Four different Phosphorus fertilizer doses were evaluated in the study. All the other agronomic practices except Phosphorus fertilizer doses were kept uniform for all treatments. The parameters determined were plant height, leaf length, number of leaves per branch, number of leaflets per leaf, green fodder yield and dry matter yield was recorded at 5% pod formation while grain yield was recorded at maturity. The fertilizer dose of 15-40 NP kg ha⁻¹ produced significantly taller plants, more leaf length, higher number of leaves per branch, number of leaflets per leaf, green fodder yield, dry matter yield and grain yield. Therefore the highest green fodder, dry matter and grain yields of 18.4, 4.5 and 1.6 t ha⁻¹, respectively were obtained as a result of application of 3rd fertilizer dose (15-40 kg ha⁻¹). Therefore, fertilization of 15-40 NP kg ha⁻¹ may be recommended for obtaining optimum production of vetch under rainfed conditions of Pothowar region.

Key words: Vetch, Phosphorus, Fertilizer, Growth, grain yield, pothowar.

INTRODUCTION

Vetch is a very good pasture crop and is also grown as cover crop to protect the soil from erosion. Being legumes crop they not only improve soil fertility through biological nitrogen fixation but also have excellent nutritive value (crude protein, more than 20 %). It is winter-growing legume with weak to moderate stem strength and viney growth habit. These are multi purpose crop for the production of fodder, hay, grain or green manure while providing the rotational benefits of legumes (Bull and Mayfield 1992). In winter there is often an acute feed deficit as most of the rainfed area of the Punjab and North West Frontier Province (NWFP) in Pakistan is under wheat cultivation and there is almost no green forage available (Noor Muhammad 1989). Vetch species may have a role in farming systems for the production of fodder, hay, grain or green manure while providing the other rotational benefits of legumes on fine textured neutral to alkaline and shallow duplex soils (Siddique *et al.*, 1996). Vetches were first introduced and evaluated in 1945 in western Australia (Bailey 1952, 1965) and in relation to initial work the vetch varieties i.e. languedoc, Blanchfleur, Nyabing, Mamoi and Popany were later released (Oram 1990).

Vetches are drought tolerant, can be grown on slopes and can regenerate naturally from the shattered seed during the previous year. These qualities have

rendered them as Potential winter forage crops (Hughes *et al.*, 1969). Droushiotis (1985) observed that in all varieties of common vetch, dry matter yield increased significantly when harvest was delayed from early flowering to the full pod formation stage but, crude protein content and digestibility declined with advanced maturity. However, crude protein yield increased significantly at later harvest stages. Qamar *et al.* (1999) reported that the dry matter productivity and quality of forage mixture of vetch and barley are highly promising when grown in the winter mediterranean type season at Islamabad being the potential option to farmers. Turk and Tawaha (2001) concluded that Phosphorus application significantly affect the seed yield, number of pods per plant, number of seeds per pod, number of primary branches per plant, 100 seed weight, pod length and seed weight per plant of Vetch. Karadag and Buyukburc (2001) observed that Phosphorus treatment enhanced all the parameters investigated in vetch. He concluded that 12-kg P₂O₅ could be recommended for optimum root, stem and nodule development in the vetch species studied.

Hence present study was conducted to determine (a) the effect of P fertilizer on fodder and grain yield of Vetch (b) To promote Vetch cultivation in pothowar region to fulfill the fodder requirements.

MATERIALS AND METHODS

The experiment to evaluate the optimum fertilizer dose for maximum growth, development and yield of vetch was conducted under rainfed conditions at National Agricultural Research Centre, Islamabad during 2001-02 and 2002-03. Soil type was non-calcareous silty clay with pH 7.4, organic matter 1.75%, Nitrogen (nitrate), extractable phosphorous and potassium 4.46, 17.26 and 121.30 mg kg⁻¹, respectively. The experiment was conducted in randomized complete block design (RCBD) with three replications. The plot size was 18 m². Vetch variety "Cyprus local" was planted during third week of October each year in this study. A seed rate of 40 kg ha⁻¹ was hand drilled by keeping 30 cm row-to-row spacing. Four fertilizer doses of N& P (source of N is from Urea and P from Single Super Phosphate) viz. F1: 15-0, F2: 15-20, F3: 15-40 and F4: 15-60 kg ha⁻¹ were applied. Total quantity of fertilizer in each treatment was applied at the time of sowing. All the other agronomic practices except fertilizer doses were kept uniform for all the treatments.

The crop was harvested at 5% pod formation from each plot for estimation of green fodder yield. One-kg green fodder sample at harvesting time was collected at random for estimating dry matter estimation from each plot. The collected samples were weighed, dried in an oven at 60°C up to a constant weight and again weighed to calculate the dry matter yield for each treatment. Five plants were also selected at random in each plot at the time of 5% pod formation to measure

stage while grain yield was recorded at maturity. The averages of all the data obtained on various parameters were worked out for two consecutive years. The data collected was subjected to Fisher's analysis of variance technique and LSD Test at 5% probability level was applied to compare the differences among treatments means (Steel and Torrie, 1980).

RESULTS AND DISCUSSIONS

Plant Height (cm)

Plant height has a main contribution in green fodder yield and dry matter yield (Dhumale and Mishra 1979). There were significant differences for plant height between different treatments (table-1). The treatment T3 having fertilizer dose 15-40 kg ha⁻¹ exhibited tallest plants (90.83 cm) than rest of the three phosphorus fertilizer doses. The fertilizer dose T4 produced significantly smallest plants than all the other treatments but statistically at par with T1 and T2 because these fertilizer doses are not suitable for proper plant height. Similar type of results regarding plant height were reported by Ghosh (1985).

Number of Leaves per Branch

Number of leaves per branch play a vital role in enhancing fodder yield. The data given in Table-1 shows that there were significant differences among the number of leaves per branch of different phosphorus fertilizer doses. Higher number of leaves per branch were found in T3 (15-40 kg ha⁻¹) which

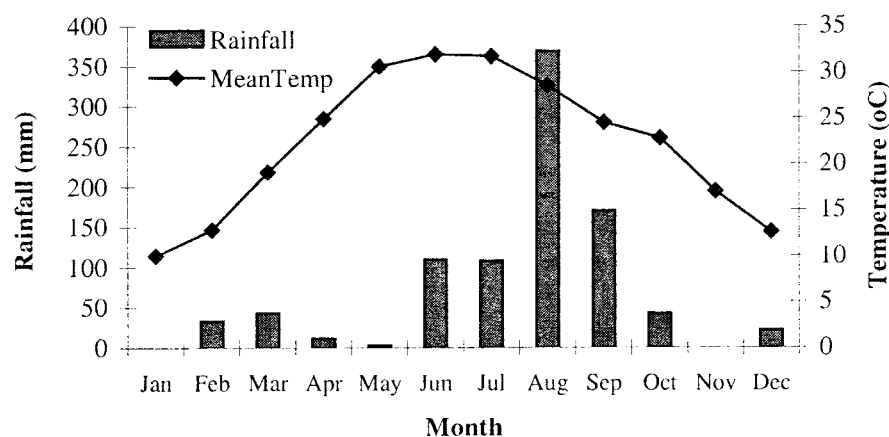


Fig 1. Monthly rainfall (mm) and mean monthly temperature (C °) during the period of study.

plant height, leaf length, number of leaves per branch and number of leaflets per leaf. Green fodder yield and dry matter yield was recorded at 5% pod formation

were (19.69) followed by T2 (17.47) and T4 (17.30). Less number of leaves per branch were observed in T1 because this treatment is without phosphorus fertilizer.

Leaf Length (cm)

Significant differences were observed in leaf length of vetch among all the treatments. Treatment T3 exhibited significantly more leaf length (10.68 cm) among all the treatments followed by the treatment T2 having leaf length (9.14 cm). The treatment T1 where no fertilizer was applied produced significantly smallest leaf length of 8.27 cm than all the other treatments. Leaf length per fertilizer dose varied due to the different fertilizer doses. The optimum dose of fertilizer resulted in more leaf length.

yield can also be associated to higher plant height, more leaf length, more tillers and leaves per tiller (Muhammad *et al.*, 1988; Zahid and Bhatti 1994). Findings of this study showed a conspicuous and significant effect of P over dry matter yield up to the dose 40 kg ha⁻¹ afterward a decreasing trend in yield was noticed. These results also confirmed the findings of Ghosh (1985) who found that up to a certain level, depending upon presence of N and P in the soil, fertilizer increased dry matter accumulation, whereas the higher dose of N and P depressed dry matter yield.

Table 1. Plant height, leaf length, number of leaves per branch, number of leaflets per leaf, green fodder yield, dry matter yield and grain yield of Vetch (Cyprus local) at varying levels of Phosphorus fertilizer.

Phosphorus treatments	Plant height	Leaf length	Leaves/branch	GFY/hect	DMY/hect	Grain yield
T1	81.61b	8.27c	15.94c	13.43c	2.249d	1.063d
T2	81.64b	9.14b	17.47b	14.93b	3.512b	1.148b
T3	90.83a	10.68a	19.69a	18.38a	4.452a	1.598a
T4	80.70b	9.08b	17.30b	15.02b	2.870c	1.102c

Green Fodder Yield (t/hect)

The treatment T3 (15-40 NP kg ha⁻¹) produced highest Green fodder yield (18.38 t ha⁻¹) due to optimum fertilizer dose and it was lowest (13.43 t ha⁻¹) in treatment T1 in each year. However differences in green fodder yields among T4 and T3 were not statistically significant (table-1). Higher green fodder yield can be attributed to taller plants, more number of leaves per branch. Since all these morphological and physiological components contribute toward green fodder yield and increase with the optimum fertilizer dose in this study. Similar type of results has also been observed by Kumar and Rai (1976). Dhumale and Mishra (1979) found a direct effect of plant height, flag leaf and tillers per plant over yield in oats. Higher number of branches can extract more nutrients from soil resulting in higher green fodder yield (Bhatti *et al.* 1985., Gill and Malik 1983; Muchow, 1988, Singh *et al.* 1987).

Dry Matter Yield (t ha⁻¹)

All the treatments differed significantly in dry matter yield in this study (Fig 8). The treatment T3 where a fertilizer dose of 15-40 NP kg ha⁻¹ was applied accumulated significantly highest dry matter (4.452 t ha⁻¹) that was closely followed by T2 with 3.512 t ha⁻¹ of dry matter on two-year average basis. While treatment T1 (2.249 t ha⁻¹) yielded significantly lowest amount of dry matter (table-1). Increase in dry matter

Conclusion: This study concluded that the application of 15-40 N & P kg ha⁻¹ resulted in higher green fodder and dry matter yields of 18.4 and 4.5 t ha⁻¹, respectively in Vetch (Cyprus local) hence can be considered an optimum fertilizer dose for higher yield under the rainfed ecology of Pothohar region.

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