DISCUSSION
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The present experiment entitled "Studies on the effect of N,P, K on growth yield and quality of betelvine (Piper betle Linn) was started during 1989-90 at Rudauli in Barabanki District of Uttar Pradesh.

The experiment was carried out in two consecutive years i.e. 1989-90 and 1990-91. The following metric observations were recorded in field and quality trials were analysed in laboratory.

1. Days to sprouting
2. Height of vine (cm)
3. Number of leaves/vine
4. Leaf area (cm²)
5. Fresh and dry weight of leaves
6. Thickness of leaves
7. Nitrogen, phosphorous and potash amount of soil after picking of leaves.
8. Yield of leaves.
9. Protein content of leaves
10. Calcium content of leaves
11. Phosphorous content of leaves and
12. Carotene content of leaves

Thus, on above mentioned trials results obtained will be discussed in this chapter.

No. of Days to Sprout

The level of nitrogen and potash fertilization indicated that
the sprouting time decreased significantly with the higher level of nitrogen 200 Kg N/ha and 60 Kg K₂O/ha.

This may be done to some toxic effects of these fertilizers which delayed the sprouting time.

**Height of Vine (cm.)**

Plant height increased significantly with the higher level of nitrogen, phosphorous and potash than the lower doses and control. The increased plant height with higher doses of nitrogen were apparently related to better supply of nitrogen under these treatments. As increasing amount of nitrogen become available to the crop, the growing internodes starts elongating quickly.

The growth in case of control plants confirm that the poor supply of nitrogen was probably responsible for the slow rate of growth and reduced plant height. The results of this investigation thus reveals that betel vine responded rapidly to nitrogen. The results were in confirmation with findings of Zahnky and Dubey (1934), Chandnani (1959), I.C.A.R. Annual reports (1955-56), Anon. (1955-57) and Annual reports 1990-91.

**No. of leaves per vine and leaf area**

Increasing level of nitrogen, phosphorous and potash increased the no. of leaves as well as leaf area respectively.

The increase in number of leaves and leaf area in plants with higher fertilizer levels is due to better availability of these nutrients especially the ammonical forms of nitrogen. The betel vine plant generally seem to prefer ammonical forms of
nitrogen in their early growth and nitrate at later stages. It may be pointed out that higher growth rate at early stages, the better would be the climatic performance of the crop. However, the importance of providing necessary nourishment to the vines can not be ignored.

The results obtained for above trials may be compared by findings obtained Chandnani (1954). Anon. 1955-57 and Anon 1990-91 which also indicated that nitrogenous phosphatic as well as potash were equally effective for production high number leaves as well as larger leaf area. Besides, Pandey et al (1982) reported that 30 quintal of sesamum oil cakes along with 200 Kg N+80 Kg P₂O₅+40 Kg K₂O per hectare gave maximum yield of leaves.

While Anon (1987) published that 150 kg N in the form of urea and mustard cake at 1:1 in four split doses along with 100 Kg each P₂O₅ and K₂O resulted maximum yield of betel leaves. Thus above findings supports the results of present investigation in the particular zone also.

**Fresh and dry weight of leaves**

Critical analysis of data reveals that fresh and dry weight of leaves were increased significantly by increasing levels of nitrogen, phosphorous and potash. The significant increase in fresh and dry weight of leaves were recorded due to supply of higher doses of N,P,K i.e 200 Kg, 80 Kg, 60 Kg per hectare respectively. This indicates that higher doses of N,P and K are essential for producing more healthy and vigorous plants. The increase in fresh and dry weight due to high level of fertilizer
may be the fact that nitrogen leads to increase the vegetative growth of plants and multiply the production of carbohydrates as well as enhanced the number of leaves per vine.

While as it is evident that role of \( P_2O_5 \) during cell division and cell elongation in meristematic region, increases the vegetative development of plant which ultimately produced more fresh and dry matter weight as it is well known that potassium plays an important role in maintainance of cellular organization, permeability of membrane, balance of water in protoplasm and acts as activator of enzymes involved in protein and carbohydrate metabolism, further potassium also helps in carbohydrate translocation, synthesis of protein, maintaining water balance in the system. Enhances the plants ability to resist cold diseases and other adverse condition. Thus these facts support the role of \( K_2O \) for producing higher fresh and dry matter weight of leaves in turn by producing healthy and fresh leaves which is required quality trait.

Anon (1987 e), Anon (1987 f) and Balasubrahmaniam et al (1991) emphasized that optimum response for fresh and dry matter weight, plant vigour and other yield contributing traits were obtained at levels between 200-300 Kg N per hectare particularly when inorganic nitrogenous fertilizers were used on sandy soil. Annual report (1990-91) of I.C.A.R. at TNAV Sirugamani indicates that maximum fresh weight were obtained when N 200 Kg per hectare was applied at four monthly split doses. This also reports that weight of 100 leaves was significantly more at 100 Kg \( P_2O_5 \) per hectare application. Above findings, in turn, supports the re-
results of present investigation.

**N.P.K. amount of soil after picking of leaves**

Higher level of nitrogen application along with phosphorous allowed more absorption of nitrogen from soil than the lower level indicates better nitrogen uptake by the crop in combination with phosphorous however uptake of phosphorous by crop were not influenced by different levels of nitrogen application while the uptake of phosphorous by the crop was higher in case of high dose of $P_2O_5$ i.e. 80 Kg per hectare. Through $K_2O$ and interactions among NPK were not effecting utilization of $P_2O_5$ by the crop.

While uptake of potash by crop was influenced by nitrogen and phosphorous application. However, application of potash showed marked uptake of potash by the crop.

Thus the results obtained indicates the uptake of NPK by the crop increases while increasing the level of these fertilizers. This shows at higher level of fertilizer growth and its contributing trails viz. plant height, number of leaves and leaf area performs better than lower level which in turn indicates effective uptake by the crop at higher doses. The findings of the experiments conducted may be supported by the reports of Choudhary 1970 as he obtained that a yield of 20 tonnes of above ground green growth per hectare removes 140 Kg of Nitrogen, 55 Kg of Phosphorous and 220 Kg of potassium in celery a vegetative crop.
Yield of leaves

The results of present investigation reveals that an increasing trend of yield of leaves were obtained while, increasing level of NP and K respectively. Since results obtained indicates that while increasing the level of NPK number of leaves increases significantly which ultimately produced high leaves yield. This is widely supported by Prirish millor (1940), Lal and Yadav (1951) Sethi et al (1952) which indicates high nutrient concentration produced greater vegetative growth and larger yield and they are interrelated with each other. Singh (1959) reported that high leaves yield and number of leaves per vine were closely related with the development of vines.

Since betel vine is a leafy crop therefore it can be compared with other leafy crops also. As in case of spinach which require more nitrogen and higher nitrogen levels increased the yield and dry matter content of the tops ( Verma et al, 1969; Choudhary et al, 1974). Further it was reported by Cervete (1969) and Stanilova et al (1972) that yield is closely related to available nitrogen and it was increased by nitrogen in combination with potash. Langdale et al (1971) obtained highest fresh yield of spinach with 150 Kg nitrogen/ha. A split fertilizer application (half at sowing and half one month later) was more effective than a single application at sowing (Vergini and Huguet, 1971). In Basella also rich soil is essential for a good crop and only nitrogenous fertilizer application has been found beneficial. Application of K at high doses had no significant effect on yield. But improved quality. Tafuri et al (1972). But according
to Adams et al. (1978) both yield and quality were increased with
the application of K fertilizer. These findings support the
results obtained in present investigation.

**Phosphorous Content of Leaves**

Phosphorous content of leaves in present investigation was
greatly influenced by increasing the level of N and P$_2$O$_5$. However
K$_2$O has insignificant role in producing phosphorous content of
leaves. This indicates that role of N and P$_2$O$_5$ is more in
synthesizing phosphorous in leaves and increases the quality of
leaves.

**Protein, Calcium and Carotene Content of Leaves**

The results of present investigation indicates that protein,
calcium and carotene content of leaves significantly influenced
by increasing the level of nitrogen while phosphorous and potash
has no significant role in its content in leaves. This is widely
supported by the work of Rodriguez (1949), Chhonkar (1952), Moon
(1954), Embleton (1956) by emphasizing that larger amount of
protein in level of nitrogen which attributed to greater avail-
ability of nitrogen and subsequently its more elaboration in the
forms of nitrogenous compounds in the leaves.

The effect of nitrogen fertilization on the chemical composi-
tion of leaves was also reported by Singh (1959). It is reported
that quality of spinach is also influenced by fertilization.
Nitrogen application increased the protein contents of Spinach
( Kasal et al., 1981; Nicolaosen and Kubien 1970). Nitrogen in
combination with phosphorous and potash increased dry matter,
crude protein and vitamin C contents in spinach as reported by Stanilova et al (1972). While, in Amaranthus species Subbiah (1979) studied the influence of n and K and reported that nitrogen increased the plant crude protein, carotene and chlorophyll contents but K had no such marked effects.

Thus present findings regarding trend of protein, calcium and carotene content of leaves which significantly influenced by nitrogenous fertilizer match with the results reported by above scientists.