SUMMARY

For the present investigation three sites differing in agricultural practices with three different crops viz. potato, maize and paddy were selected. These were (i) valley practice at Kyntonmassar (altitude 1000 m.s.l) (ii) terrace practice near Sanker rehabilitation centre (altitude 1100 m.s.l) and jhum practice at Umphyrnai near Smit (altitude 1600 m.s.l or 1625.25 m.s.l).

For the isolation of endogonaceous spores from rhizosphere soil, cast and gut content of earthworm, wet sieving decantation method of Gerdeman and Nicolson (1963) was followed. It was found that the endogonaceous spores isolated from rhizosphere soil, cast and gut content of earthworm were highest in valley practice followed by that in terrace and the least was found in jhum practice. The highest number of spores were found in rhizosphere soil as compared to cast and gut content in all the three agricultural practices.

For mycorrhizal infection, Phillips and Hayman's (1970) method was followed. It was observed that the VAM infection level i.e. total number of external hyphae, total number internal hyphae, total number of entry points, total number of vesicles, total number of arbuscules and percentage infection was highest in soil of valley practice followed by terrace and least was recorded in jhum practice during the study period. It was also found that the percentage infection was highest in potato crops as compared to maize and paddy crops in three agricultural practices. The infection level in maize, paddy and potato crops of valley practice were mostly positively correlated,
in terrace practice it was found that in all the three crops the external hyphae was negatively correlated with entry points and internal hyphae, and in jhum practice it was found that in maize, paddy and potato crops the external hyphae and entry points were positively correlated with internal hyphae, vesicles, arbuscules and percentage infection.

For the estimation of hyphal biomass, Ride and Drysdale's (1972) method was followed. It was found that the hyphal biomass in soil was maximum in valley practice followed by terrace and minimum was found in jhum practice. During the months of Mar-May, the hyphal biomass declined in the soil of jhum practice. Maximum hyphal biomass was recorded in paddy field soil than that in case of maize and minimum in potato field.

For the diversity of VAM fungi under different agricultural practices, the spores were isolated by wet sieving and decantation method (Gerdeman and Nicolson, 1963). The isolated VAM spores were identified as *Glomus fasciculatum*, *Gigaspora sp*, *Acaulospora sp*, *Sclerocystis sp* and *Modicella sp*. However, *Glomus fasciculatum* was found to be the dominant in all the three agricultural soils. Maximum spores were isolated in cast and gut content of earthworm collected from valley practice followed by that in terrace and minimum was recorded in jhum practice.

For the estimation of soil pH, moisture content and bulk density the methods described by Allen (1974) were followed. The percentage moisture content of the soil was maximum in valley land (15.16-55.41 in 1996 and 14.23-45.31 in 1997) followed by terrace land (14.12-34.23 in 1996 and 14.18-25.30 in 1997) and minimum moisture content (12.23-36.12 in 1996 and 12.19-35.51 in 1997) was recorded.
The pH of the soil was acidic in nature. The pH of the soil collected from valley practice ranged between 5.12-5.41 in 1996 and 5.02-5.66 in 1997. In terrace practice, the soil pH ranged between 5.01-5.72 in 1996 and 4.90-5.86 in 1997, whereas in jhum practice the soil pH ranged between 4.29-4.72 in 1996 and 4.05-4.73 in 1997. The bulk density of terrace practice was highest than that in valley and minimum in jhum practice.

For the estimation of total nitrogen, available phosphorus, and available potassium of the soil samples, semimicro-Kjeldahl method, molybdenum blue method and flame photometer method were followed respectively. Walkley and Black's rapid titration method (1934) was followed for the estimation of organic carbon. It was found that percentage nitrogen content of soil in valley practice was highest (0.201-0.512) followed by terrace (0.102-0.418) and least in jhum practice (0.101-0.323). Similar trend was found in case of available phosphorus, available potassium and organic carbon content of the soil during the study periods.

For the role of VAM fungi in nutrient uptake from soil of three different agricultural practices to three different crop plants (potato, maize and paddy), the experiment was conducted in three different agricultural practices taking an area of 1m length x 1m breadth size. The soil was sterilised with 4% formalin and in each field 50 sterilised paddy seeds, 20 sterilised maize seeds and 10 sterilised potato seeds were sown separately in pure cropping system as well as in combination in mixed cropping system. In the first set of experimental plot, soils were inoculated with 200 number of VAM spores (Z) i.e. (Glomus fasciculatum, Gigaspora sp., and Sclerocystis
sp. mixed together) in pure and mixed cropping systems. In the second set of experimental plot, soils were inoculated with 100 number of VAM spores (Y) of same species in pure and mixed cropping systems. The third set of experimental plot was treated as control (X), where no VAM spores were inoculated in both pure and mixed cropping systems. The study was carried out for a period of six months. For each crop, samplings were done at 30 days interval. N (%), P (%) and K (%) of soil were analysed following semimicro-kjeldahl method, molybdenum blue method and flame photometer method respectively (Allen, 1974). It was observed that the uptake rate of nitrogen (%), phosphorus (%) and potassium (%) in valley practice was highest in the set inoculated with double number (Z) of spores, moderate in the set inoculated with half number (Y) of spores and least was found in control set in three different crops of both pure and mixed cropping systems.

The N (%), P (%) and K (%) of three different crops (potato, maize and paddy) were also analysed at 30 days interval. For the analysis of total nitrogen semimicro-kjeldahl method was followed. Triacid digestion method was followed for the analysis of phosphorus and potassium (Allen, 1974). It was found that the N (%), P (%) and K (%) of different crops were maximum in double number of inoculated set than that in half number of inoculated set and minimum uptake rate was found in control set. It was found that in three field conditions in three different crops (potato, maize and paddy) and in different treatment levels, the nutrient uptake rate i.e. N (%), P (%) and K (%) were positively significant with different treatment levels from 30-120 days in pure cropping system (r = 1.000 and 0.997 at 1 % and 5 % respectively). Whereas from 150-180 days negative correlation was found. In
mixed cropping system, positive correlation was found till 90 days with different
treatment levels in three different crops. In maize crops of both pure and mixed cropping
systems the nutrient uptake was maximum and minimum nutrient uptake was recorded in
potato crops. In all the three different agricultural fields the nutrient i.e N (%), P (%) and
K (%) uptake was found to be maximum in valley practice followed by terrace and
minimum was recorded in jhum practice in both pure and mixed cropping systems.

For the interspecies interaction of crops and VAM compatibility in soil of three different agricultural practices (valley, terrace and jhum) in
three different crop plants (potato, maize and paddy) the experiment was conducted in
pots. The soil from three different agricultural practices were collected and 10 kg of soil
from each crop field was sterilised in autoclavable polythene bags at 15 psi in an
autoclave for one hour. Then the sterilised soils were transferred to different earthen
pots. In each pot sterilised seeds of paddy (10), maize (5) and potato (3) were sown
separately for pure cropping system as well as in combination for mixed cropping
system. In the first set of pots, soils were inoculated with 200 number (Z) of VAM
spores (80 Glomus fasciculatum, 80 Gigaspora sp, and 40 Sclerocystis sp) separately in
pure and mixed cropping systems. In the second set, 100 spores number (Y) i.e 40
Glomus fasciculatum, 40 Gigaspora sp and 20 Sclerocystis sp were inoculated separately
in pure and mixed cropping systems. In the third set, no VAM spores were inoculated
which was treated as control set (X) in both pure and mixed cropping system. Three
replicates were maintained for each set for each cropping system (pure and mixed). The
study was carried out for a period of six months.
The VAM compatibility (total number of external hyphae, total number internal hyphae, total number of vesicles, total number of arbuscules and percentage infection) and growth of crops (length of crops and number of leaves) were estimated at 30 days interval by Phillips and Hayman's (1970) method. The nutrients i.e N (%), P (%) and K (%) of soils were analysed following the methods of semimicro-kjeldahl, molybdenum blue, and flame photometer respectively (Allen, 1974). The nutrients of three separate crops (potato, maize and paddy) were also analysed at 30 days interval following the methods of semimicro-kjeldahl and triacid digestion respectively (Allen, 1974). It was observed that N (%), P (%) and K (%) in the soil of valley practice were highest in the pots inoculated with double number (200) of spores, moderate in half number (100) of spores and least in control pots followed by moderate uptake rate i.e N (%), P (%) and K (%) in the soil of terrace practice and the soil of jhum practice showed least nutrient uptake rate in both pure and mixed cropping system.

It was also observed that the infection level and growth of crop plants were highest in the set of valley practice in double number of inoculated spores (Z) followed by half number of inoculated spores (Y) and lowest infection was found in control (X) sets, whereas, terrace practice soil showed moderate growth of crop plants and in jhum practice least growth of crop plants was observed in both pure and mixed cropping systems. The maximum nutrient uptake rate was found in pure cropping system than mixed cropping systems.

It was observed that in three different soil conditions and crops the nutrient uptake and VAM compatibility were positively
correlated with the inoculated spores \( (r =1.000 \text{ and } 0.997 \text{ significant at } 1\% \text{ and } 5\% \text{ respectively}) \). It was also found that the infection level and growth of crop plants were positively correlated with the inoculated spores in both pure and mixed cropping systems. \( (r =1.000 \text{ and } 0.997 \text{ significant at } 1\% \text{ and } 5\% \text{ respectively}) \).