greatly mineralized in soils treated with soybean cake, rape cake, and castor cake due to their low C/N ratio, but was low in soils receiving rice-bran cake (high C/N ratio). Despite its relatively high C/N ratio, however, the application of palm cake seemed to immobilize N during the initial incubation (2 day), and thereafter N began to mineralize. Nitrogen isotope fractionation effect was considerable in soils treated with soybean cake, rape cake, and castor cake. In pot experiment, the pattern of N mineralization was similar to that in incubation during the early growth stage, but soil inorganic N concentration decreased 30 days after transplanting (DAT) because of N absorption by Chinese cabbage. Except control, δ15N of soil N tended to increased gradually and that of Chinese cabbage rose above 10 ‰ at the end. Despite the low δ15N of oil-cake, however, plant-δ15N was considerably high at harvest, suggesting that the pattern of N mineralization of oil-cake is different that of composts.

S14.033
Growing Methods and Nutrient Management in Organic Greenhouse Production of Vegetables

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The research cycle encompass year-long organic vegetable greenhouse production. Spring crop was grown pickling cucumbers followed by autumn tomato. During winter month without heating annual cover crops (mixture of oat, hairy vetch and field peas) were grown and as a green manure incorporated to the soil in spring before cucumber cultivation. Additional organic fertilizers (compost and chicken manure) were applied before cucumber and tomato planting. In the period between cucumber and tomato cultivation the soil in greenhouse was solarizated. In both crops soil surface was mulched with black fleece or fresh red clover biomass. Transplants of both species were produced in organic substrate. Cucumbers were planting in the soil but tomatoes in bottomless containers of 0.5 dm^3, placed directly on the soil surface. The period of cucumbers growing was 90 days and tomatoes 120 days. Every 2 – 3 weeks in cultivation period nutrients concentration in soil solution was monitored on the depth of 30 and 60 cm. Growth development, earliness, yield and quality of fruits were determined. Red clover mulch positively influenced on cucumber and tomato growth and yield when applied early in the season, soon after transplant planting. In the initial period of plant growth (till fruiting) considerable amounts of nutrients (mainly nitrogen and potassium) were leached to the soil depth of 30 and 60 cm. After fruits setting and during fruits growth nutrient contents in soil solution considerably decreased and necessity of additional nutrients supply appeared. It was done by fertigation. In Polish climate condition soil solarisation in summer months decreased the total number of soil microorganisms and was more effective while good insolation.

S14.034
Comparing Conventional and Improved Organic Vegetable Rotations, Yields and Nitrogen Husbandry

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During 2005 to 2009 three approaches to organic vegetable rotations were compared to a conventional rotation in an interdisciplinary project. The organic rotations differed in their reliance on animal manure vs. cover crops and intercrops, but the rotation of main vegetable and cereal crops were identical in the four rotations. One organic rotation (O1) relied on import of manure for supply of nutrients, in another (O2) cover crops were used to replace most of the manure import, and in (O3) also intercrops were grown to improve natural pest regulation. The yearly import of nitrogen were on average 149, 94, 28, and 28 kg N·ha-1 in C, O1, O2, and O3 respectively. On average the yield in the O1 system was 83% of the yield in the conventional system. In the O2 rotation the yield was the same, though the nutrient import was much lower, whereas the intercrops in O3 reduced the yield to 70% of the conventional rotation. The effect on single crops varied with organic yields ranging from 60% (onion) to almost 100% (carrots, oats) of conventional yields. Crop root growth varied strongly among crops with rooting depths of less than 0.4 m (onions) to more than 2 m (cabbage, rye, fodder radish catch crop). Root growth was unaffected by cropping system, but the inclusion of deep rooted catch crops and green manures in O2 and O3 increased the total root exploitation of the soil strongly. Thus, while the O1 and O2 systems had almost identical yields and N uptake there were large differences in their effects on soil N; e.g. the subsoil (1-2.5 m) N content was on average 18 kg $N{\cdot}ha^{-1}$ in the O2 compared 61 and 53 kg $N{\cdot}ha^{-1}$ in the C and O1 respectively, indicating strongly reduced N leaching losses in O2.

S14.035
Effects of Cover Crops on Yield and Quality of Organically Grown Tomatoes in Greenhouse

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This research was conducted in order to determine the effects of cover crops on yield and fruit quality of organically grown tomatoes in greenhouses during spring and autumn growing seasons of 2008 and 2009. In spring season four cover crops, namely lupen (*Lupinus albus*.), vetch (*Vicia sativa*) (as living mulch), alfalfa (*Medicado sativa*), rye (*Secale ceraale*) were compared with black PE mulch and control (no mulch). According to the results of that season slight changes were done in treatments. The tested cover crops were lupen (*Lupinus albus*), cowpea (*Vigna sinensis*), crimson clover (*Trifolium incarnatum*) and dikondra (*Dichondra repens*) (as living mulch) were compared with black PE mulch and control (no mulch) in autumn season. During the production periods, yield and fruit quality were determined and total yield changed between 10.8 (black mulch and lupen) and 3.6 (rye) kg/m^2 in spring whereas it was between 9.4 (lupen) and 5.9 (control) kg/m^2 in autumn season. It was concluded that lupen could be an appropriate cover crop for greenhouse conditions.

S14.036
Cover Crops as Nitrogen Source for Organic Farming in Southwest Europe

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The environmental concerns with the use of inorganic nitrogen fertilizers and the increasing fertilizer costs renew the importance of the search for sustainable nitrogen sources. Cover crops can be used as a nitrogen source for the following crops as a substitute for inorganic nitrogen fertilizers. The fertilizer replacement value for a following crop by different annual cover crops was evaluated in a field experiment at the Agriculture School of Viseu (Portugal) in two years from 2007 to 2009. In this study measurements were made of dry matter yield, N content of herbage and N uptake (in aerial biomass) of nine winter annual cover crops: six annual forage legumes, *Trifolium michelianum* (balansa clover), *Trifolium incarnatum* (crimson clover), *Trifolium glanduliferum* (gland clover), *Trifolium vesiculosum* (arrowleaf clover), *Ornithopus sativus* (french serradella) and *Lupinus luteus* (yellow lupine); one grass *Lolium multiflorum* (westerworld ryegrass); one mixture (ryegrass with balansa clover) and one control treatment (semi-natural vegetation). Analyses of variance revealed no significant differences for DM yield but significant differences for N content and for N uptake. Lupine was responsible for the highest N content (31.7 $g{\cdot}kg^{-1}$) and N uptake (174.4 kg $N{\cdot}ha^{-1}$). The treatment that had the lowest N content and N uptake was the ryegrass, respectively 14.7 $g{\cdot}kg^{-1}$ and 75.7 $kg{\cdot}ha^{-1}$, though the results obtained for ryegrass are not significantly different from those found for the control semi -natural vegetation (N content 19.5 $g{\cdot}kg^{-1}$ and N uptake 91.4 $kg{\cdot}ha^{-1}$). These results suggest that annual legumes have a great potential as a nitrogen source for the following Spring or Summer crop, and this potential depends essentially on the type of cover crops used, and their N content when used for green manuring.