Summary

A series of experiments were conducted in the laboratory and in the green house to find evidence of the allelopathic potential of *Tithonia diversifolia* (Hemsl.) A. Gray (Mexican sunflower) and to determine the factors affecting production, release and phytotoxic activity of phytotoxic substances from this plant in soil. These experiments were carried out in order to obtain the basic information on the allelopathic potential of Mexican sunflower under natural conditions in mountainous areas for its conservation, and better weed management in sustainable agriculture harmonious to the environment. The results from all the experiments are summarized as follows.

Water extract from the mature leaves of Mexican sunflower at the concentration of 10 mg DME/ml showed a slight effect on seed germination but caused significant reduction on seedling growth of most of the plant tested. The extract at the concentration of 20 mg DME/ml remarkably inhibited seed germination and seedling growth. The degree of inhibition on plant growth varied depending on plant species and the root growth was more sensitive than the shoot growth. The inhibitory activity of water extract from green leaves and senescent leaves on the growth of rice seedlings used as the test plant were similar, and the activity of leaf water extracts was greater than that of the extract from stems or roots. These results demonstrated that

the leaves, stems and roots of Mexican sunflower contain some water extractable growth inhibitory substance(s) which could inhibit seed germination and seedling growth of other plants, but the activity and/or the amount of the substance(s) was dependent on the part of Mexican sunflower.

The soil previously planted with Mexican sunflower for 6 months and its soil-water have a capacity to inhibit shoot and root growth of test plant seedlings. Mexican sunflower leaf water extract at the concentration of 10-20 mg DME/ml applied into soil and Mexican sunflower leaf powder incorporated in soil at the ratio of 10-20 mg/g dry soil significantly inhibited the shoot and root growth of tested plants. The phytotoxic activity of leaf water extract and leaf powder applied into soil on the growth of rice seedlings used as the test plant could be maintained in soil for several weeks depending on the application rate. The dynamic pattern of phytotoxic activity of soil treated with Mexican sunflower extract or leaf powder correlated well with that of its soil-water. These results suggested that Mexican sunflower could release phytotoxic compound(s) into soil and may have phytotoxic activity under natural conditions.

The inhibitory activity of Mexican sunflower water extract on the growth of rice seedlings varied among soil types. The phytotoxic effect of Mexican sunflower extract on rice seedlings grown in non-autoclaved soil was less than in autoclaved soil, and the inhibitory effect on rice seedlings grown in autoclaved soil

was less than in autoclaved sand. These results suggested that the decrease in phytotoxic activity of Mexican sunflower extract in soil is due to the soil adsorption and microbial degradation.

The water leachates from air-dried green and senescent leaves of Mexican sunflower obtained by water spray have an inhibitory activity on the growth of rice seedlings in soil. The phytotoxic activity of the leaf water leachates was dependent on both the amount of Mexican sunflower leaves and the amount of water spray. These results suggested that phytotoxic substance(s) in the green and the senescent leaves of Mexican sunflower could be eluted by rain and has a potential to inhibit growth of other plant seedlings in soil.

Shoot and root growth of rice seedlings was inhibited in each soil layer of the dry and wet soil columns previously treated with water extract from Mexican sunflower leaves. The degree of inhibition on rice seedling growth varied among the soil layers and differed between the dry soil column and the wet soil column. The inhibitory activity on rice seedling growth in the soil layers was dependent on the amount of phytotoxic substance(s) contained in the soil-water of each soil layer. Growth of rice seedlings in the soil layers of the soil column which was placed with the soil previously applied with Mexican sunflower leaf extract was inhibited, and the pattern of rice seedling growth in response to the soil was similar to its soil-water. These results suggested that phytotoxic substance(s) in Mexican sunflower

leachate by rain could move down from the upper soil layers to the lower layers of the soil profile. The downward movement of phytotoxic compound(s) in soil are affected by water movement and soil moisture condition.

Plant height, leaf area, fresh weight, and dry weight of leaves, stem and roots of Mexican sunflower were reduced with decreasing soil moisture level. The phytotoxic activity of water extract from each part of Mexican sunflower grown under low soil moisture levels was greater than that of water extract from the same part of the plants which were grown under higher soil moisture levels. Soil previously planted with Mexican sunflower at different soil moisture levels inhibited rice seedling growth to a similar extent. Soil-water separated from the soil previously planted with Mexican sunflower at different soil moisture levels inhibited rice seedling growth, and no significant difference in the phytotoxic activity was observed among the planted soils under different soil moisture. These results suggested that under water stress condition, the growth of Mexican sunflower decreased but the plant could produce and store the phytotoxic substance(s) in the leaves, stem and roots in a greater amount than the plant grown under non-water stress condition. The water stressed plants could release phytotoxic substance(s) into soil by the process of root exudation and were able to maintain the phytotoxic activity in soil similar to the non-water stressed plant.

Based on these findings, it is concluded that Mexican

sunflower could produce and release phytotoxic substance(s) into soil and has allelopathic potential under natural field conditions. Water extractable phytotoxic compound(s) leached from leaves by rain and root exudate might be accumulated and partially adsorbed and move in soil, and exhibit the allelopathic potential. The allelopathy of Mexican sunflower may be valuable in the improvement of weed management in sustainable agriculture in the future.