ABSTRACT

Impact of sulphur dioxide and fly ash on growth and productivity of rapeseed and sunflower and on Alternaria blight of rapeseed

SHAZIA SIDDIQUI

Abstract of the thesis, submitted to the Department of Botany, Aligarh Muslim University, Aligarh, India, for the degree of Doctor of Philosophy in Botany, 2001.

Six experiments were conducted with an aim to elucidate the effect of SO₂ and fly ash on growth and productivity of rapeseed and sunflower and on Alternaria blight of rapeseed.

The salient features of the observations, recorded in each of the six experiments, are summarised below:

Section I

It covers the experiments on the impact of SO₂ and fly ash on growth and productivity of rapeseed and their effect on Alternaria blight caused by Alternaria brassicicola.

Experiment 1

In this experiment, the plants of three cultivars (T-7, TL-85 and TH-68) of Brassica campestris were exposed to three graded concentrations (142.85, 285.71 and 571.43 μg m⁻³) of SO₂ in the presence or absence of Alternaria brassicicola. It was observed that SO₂ significantly decreased chlorophyll, nitrogen, phosphorus, potassium and all the growth characteristics (length, fresh and dry weight) both of the
shoot and the root and seed yield, at harvest. The rate of loss is directly proportional to the SO$_2$ concentration. The plants infected with *A. brassicicola* were affected most by SO$_2$. However, the cultivar TL-85 exhibited slight resistance to the pollutant.

**Experiment 2**

The healthy and diseased plants of three cultivars (T-7, TL-85 and TH-68) of *B. campestris* were grown in the sandy loam soil, amended with graded levels of fly ash (0, 20, 40, 60, 80 and 100%, w/w). All the parameters (growth characteristics, chlorophyll, carotenoids, phosphorus and potassium contents in the leaves) and seed yield, at harvest exhibited a significant response to fly ash. The values increased with an increase in the level of fly ash up to 60% but decreased with a further increase in the fly ash level. However, nitrogen content decreased significantly. At all the levels of fly ash, the plants infected with the fungus had the values, for all the characteristics, comparable with that of the healthy (control) plants. The seeds possessed a safe amount of heavy metals but were more than those of the control (0% fly ash). Among the cultivars, T-7 proved best by having a rich growth and seed yield.

**Experiment 3**

The healthy and infected (*A. brassicicola*) plants of three cultivars (T-7, TL-85 and TH-68) of *B. campestris* were dusted with 2, 5 and 8 gm of fly ash per day. A fly ash level up to 5 gm day$^{-1}$ significantly improved the growth characteristics, leaf chlorophyll and nutrient contents, except nitrogen, and the seed yield but the highest dose (8 gm day$^{-1}$) proved
harmful. The diseased plants exhibited a negative impact with the fly ash and the values decreased significantly below that of the healthy control. The seeds possessed a larger quantity of heavy metals but this level was very much below the permissible limits. The values for most of the parameters were maximum in variety T-7.

Section II

In this section, physiomorphological characteristics and productivity of sunflower, in response to SO$_2$ and fly ash, was included.

Experiment 1

The seeds of four cultivars (Morden, PSF-5, CSFH-778 and NSFH-110) of *Helianthus annuus* were sown in pots, filled with sandy loam soil. The plants raised from these seeds were exposed 21 days after sowing, to three concentrations of SO$_2$ (142.85, 285.71 and 571.43 μg m$^{-3}$) in the exposure chamber. The plants exhibited a significant linear decrease in growth, leaf chlorophyll, carotenoid, nitrogen, phosphorus and potassium contents and seed yield with an increase in the SO$_2$ concentration. However, sulphur content increased. Among the various cultivars, Morden somehow gave a bit of resistance to the pollutant.

Experiment 2

The plants of four cultivars (Morden, PSF-5, CSFH-778 and NSFH-110) of *H. annuus* were raised in the pots filled with a mixture of sandy loam soil and fly ash, where the latter was 0, 20, 40, 60, 80 and 100%. The presence of fly ash generated a significant impact on all the physiomorphological characteristics of the plants. The length, fresh and
dry weight both of the shoot and the root, leaf chlorophyll, carotenoid, phosphorus and potassium contents and seed yield, at harvest, increased significantly with an increase in the level of fly ash up to 40%. A further increase in its level had no additive effect but the values started decreasing, above 60% of the fly ash. However, the nitrogen content decreased significantly with an increase in fly ash content from 0 to 100%. The presence of fly ash marginally increased the heavy metal status in the seeds, at harvest. Among all the cultivars, Morden gave maximum response to the treatment.

Experiment 3

This experiment was designed in a way to assess the impact of foliage deposited fly ash on plant growth and productivity of sunflower. Seeds of four cultivars (Morden, PSF-5, CSFH-778 and NSFH-110) of *H. annuus* were sown in the pots, filled with sandy loam soil. Fifteen day old seedlings were regularly dusted with fly ash at the rates of 2, 5 and 8 gm per day, up to day 60. It was noted that the plants gave a favourable response to fly ash up to a level of 5 gm day⁻¹ where the value for length, fresh and dry weight of shoot and root, leaf chlorophyll, carotenoid, phosphorus and potassium contents and seed yield at harvest, were maximum. However, the plants dusted with the maximum quantity (8 gm day⁻¹) of fly ash had the values, for all the parameters, below than those of the control (0% fly ash). The seeds, obtained from the treated plants, possessed larger quantities of heavy metals but were very much below the permissible limits. The treatment had the maximum effect on the cultivar, Morden.