CLIMATE CHANGES & PLANT RESPONSES | Rashtriya Krishi | Volume 8 | Issue 2 | December, 2013 | 44-45

Climate changes and plant responses

S.K. Priyadarshini and B. Manjula
Tamil Nadu Agricultural University, COIMBATORE (T.N.) INDIA

World is experiencing climate change in form of Increasing temperature, Rising sea level, Widespread melting of snow and iceglobal average and Increasing CO_2concentration which can be criticized for all those changes. Projections to the year 2100 indicate that CO_2 emissions are expected to increase by 400% and CO_2 atmospheric concentrationis expected to increase by 100% (Cline, 2007).

Projections to the year 2100 indicate that CO_2 emissions are expected to increase by 400%and CO_2 atmospheric concentration is expected to increase by 100% (Cline, 2007).

Plant responses to elevated CO_2 : First Climate change which took place 350 million years ago that decreased the CO_2 content, and which is considered to be responsible for the appearance of leaves. The first plants were leafless and it took nearly 40–50 million years for leaves to appear (*Beerling et al.*,2001), but effects seems to be changed with increased CO_2 levels and its interactive, direct and indirect effects.

The rise in atmospheric carbon dioxide (CO_2) concentration from about 280 µ mol/mol before the industrial revolution to about 360 µ mol/mol currently is well documented (Baker and Enoch, 1983; Keeling *et al*, 1995). There is a report that Increasing CO_2 concentration leads to decrease in the number of stomata (Gray *et al*., 2000). HIC is the gene involved in the signal transduction pathway responsible for controlling stomatal numbers at elevated CO_2. In case of Recessive *hic* allele, there is an increase of up to 42% in stomatal density in response to a doubling of CO_2. Reduction in stomatal density may increase the plant's potential for increased water-use efficiency with increasing CO_2 (Gray *et al*., 2000).

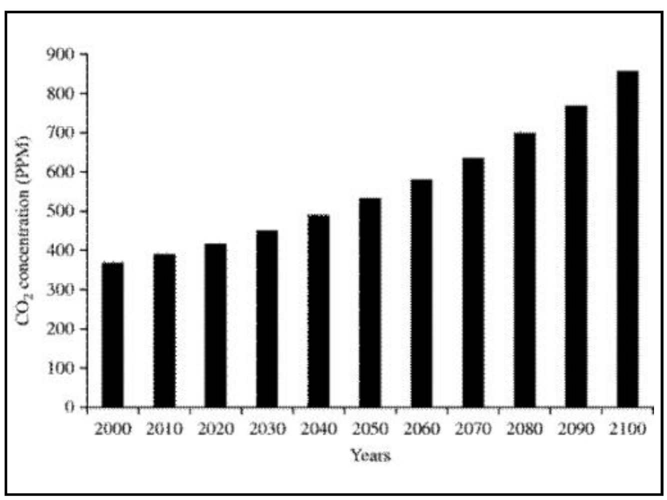
The consensus of many studies done in free-air concentration enrichment (FACE) (Long *et al*., 2006) on the effects of elevated CO_2 is that the CO_2 fertilization effect in plants is real. As a consequence, crop growth and biomass production may increase by up to 30% for C3 plants at doubled ambient CO_2; however, other experiments show biomass increases of only 10–20% under doubled CO_2 conditions. In theory, at 25°C, an increase in CO_2 from the current 380–550 ppm (air dry mole fraction), projected for the year 2050, would increase photosynthesis by 38% in C_3 plants. It is well established that elevated CO_2 increases photosynthetic C fixation and carbohydrate synthesis (Long *et al*., 2004); however, this research suggests that at the transcript level, elevated CO_2 also stimulates the respiratory breakdown of carbohydrates, which likely provides increased fuel for leaf expansion and growth at elevated (CO_2).

Castro *et al*. (2009) reports the reproductive development of soybean and possibly other vegetation will be directly affected by rising atmospheric CO_2 and to project development of crops and vegetation in general, under global change, it is not only necessary to quantify the effects of climate but also the direct effects of rising CO_2.

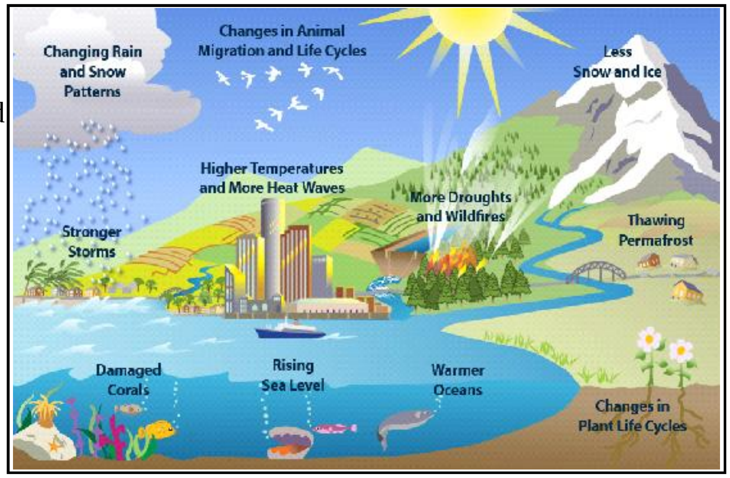
Table 1 : World carbon dioxide emissions from the consumption and flaring of fossil fuels, 2006 (million metric tones of carbon dioxide)

1.China	21.50%
2. United States	20.20%
3. Russia	5.50%
4. India	5.30%
5. Japan	4.60%
6. Germany	2.80%
7. UK	2.00%
8. Canada	1.90%
9. South Korea	1.70%
10. Italy	1.70%

Source: energy emission administration



In case of C4 plants (e.g. maize and sorghum) RuBisCO is localized in the bundle sheath cells in which CO_2 concentration is 3 to 6 times higher than atmospheric CO_2. This concentration is sufficient to saturate RuBisCO and in theory would prevent any increase in CO_2uptake with rising CO_2. However, even in C4 plants, an increase in WUE via a reduction in stomatal conductance caused by an increase in CO_2 may still increase yield (Long *et al*., 2006).



Interactive effects: The studies on interactive effects of rising atmospheric carbon dioxide (CO_2) concentrations and elevated nitrogen (N) deposition on plant diversity are also going on, but still not well understood. Ina report by Peter B. Reich in Science 2009 from10 yearslong-term of open-air experiment, grassland assemblages planted with 16 speciesgrown under all combinations of ambient and elevated CO_2 and ambient and elevated N shows that elevated N reduced species richness by 16% at ambient CO_2 but by just 8% at elevated CO_2. This shows the multiple effects of CO_2 and N on plant traits and soil resources that altered competitive interactions among species.

How ever these studies and their simulated results would not really not come in rescue of the crop productivity as the other indirect effects of increased CO_2 like increased temperature which also responsible for snow melting and sea level rise could cause changes in land, soil and water resources, changes in ocean salinity, Increased weed and pest challenges as they too evolve and Increasing frequency of drought is highly probable. Thus decline in yields and production, reduced marginal GDP from agriculture is certain to expect which leads to increased number of people at risk of hunger and food insecurity.

Major classes of adaptation for sustained crop production in this changing global climate may include adaption for seasonal changes and sowing dates, different variety or species and new crop varieties, water supply and irrigation system forest fire management, promotion of agroforestry, adaptive managementwith suitable species and silvicultural practices.

Received : *17.01.2013* ***Revised :*** *20.10.2013* ***Accepted :*** *21.11.2013*