1. **To study the various important nutrient interactions in soil and sunflower and safflower crops.**

**Sunflower in Alfisols**

Sunflower hybrid (DRSH-1) dry matter yield varied from 1742.7 to 2522.9 kg/ha. The Ca x B interaction significantly influenced Ca and B uptake by the sunflower plant. Ca x B interaction effects were also found significant in soil available Ca and B. Application of calcium at 30 kg/ha and boron at 2 kg/ha resulted in high sunflower seed yield in Ca and B deficient red sandy loam soils.

Sunflower hybrid (DRSH-1) shoot yield varied significantly between the two years due to the seasonal, environmental and soil factors. Nitrogen and sulphur uptake by shoot showed significant variation while phosphorus uptake was found to be non-significant. Shoot yield was significantly influenced by various levels of nitrogen application (as main plot treatment) Similar trend was observed with respect to phosphorus application under sub plot treatment. In case of sulphur application shoot yield at 15 and 30 kg S/ha was found to be at par.

In general, nitrogen, P and S uptake by shoot showed significant variation under different levels of N application. Similar trend was observed in different levels of P application (sub plot treatment) too. Nitrogen uptake by shoot under sub plot treatment of S @ 0 and 15 kg/ha was found to be at par however at higher levels of S application N uptake by shoot varied significantly. P uptake by shoot was recorded highest at 45 kg S/ha and lowest in control. S uptake by shoot varied significantly across the S treatments.

*N x P interaction*

Interaction effects between N x P was found statistically significant in shoot yield. Only N and S uptake by shoot showed significant interaction.

*N x S interaction*

N x S interaction was found non-significant with respect to the shoot yield. Uptake of N, P and S by shoot was also found non-significant.

*P x S interaction*

Interaction effects between P x S was found statistically significant in shoot yield. Only N and S uptake by shoot showed significant interaction.

*N x P x S interaction*

N x P x S interaction was found non-significant with respect to the shoot yield. Uptake of N, P and S by shoot was also found non-significant.

**Sunflower in Vertisols**

Sunflower shoot yield varied significantly between the two years due to the seasonal, environmental and soil factors. Nitrogen phosphorus and sulphur uptake by shoot showed significant variation. Sunflower hybrid (DRSH-1) shoot yield was significantly influenced by various levels of nitrogen application (as main plot treatment) Similar trend was observed with respect to phosphorus application under sub plot treatment. Nitrogen, P and S uptake by shoot showed significant variation under different levels of N application. Similar trend was observed in different levels of P and S application (sub plot treatments) too.

*N x P interaction*

Interaction effects between N x P was found statistically significant in shoot yield. Only N and S uptake by shoot showed significant interaction.

*N x S interaction*

N x S interaction was found non-significant with respect to the shoot yield. In general uptake of N, P and S by shoot was also found non-significant however S uptake by shoot was influenced significantly due to N x S interaction. Interaction of N and S known to be synergistic.

*P x S interaction*

 N, P and S uptake by shoot and seed showed significant interaction.

*N x P x S interaction*

N x P x S interaction was found non-significant with respect to the shoot yield. Uptake of N, P and S by shoot was found non-significant.

**Safflower in Vertisol**

Safflower variety PBNS-12 was grown during the *rabi* seasons of 2011, 12 and 13 in the Vertisols of ICRISAT-DOR farm as per the technical programme. Year wise achievements are presented below.

***Rabi* 2011**

After the harvest of the safflower crop soil samples were collected plot wise and analysed for important available nutrients viz. N and S. Various levels of N application has influenced significantly the soil available N. N X S interaction effect was also found significant. However application of S levels did not showed any significant influence. Soil available S was significantly influenced by the interaction effect of N x S only.

Application of various levels of N and S has significantly influenced the dry matter yield of safflower at flowering stage. The interaction effects of N x S were also found significant.

Uptake of N by safflower shoot at flowering stage significantly influenced due to the application of various levels of N and S. Interaction effect of N x S was also found significant at this stage.

Uptake of P by safflower shoot at flowering stage was significantly effected by the various levels of N application. N x S interaction effects were found to be statistically significant.

Sulphur uptake by safflower shoot at flowering stage was significantly effected by the various levels of N application. N x S interaction effects were found to be statistically significant. However, at harvest stage only the N x S interaction effects was found significant in case of dry matter accumulation.

At harvest stage uptake of N by safflower shoot was significantly influenced by the various levels of N and S application. Interaction effect of N x S was also found statistically significant.

Phosphorus uptake by safflower shoot was significantly influenced due to the N x S interaction at harvest stage.

Uptake of K by safflower shoot at harvest was effected significantly due to the application of various levels of N. Interaction effects of N x S were also found significant.

At harvest stage uptake of S by safflower shoot was significantly influenced by the various levels of N application. Interaction effect of N x S was also found statistically significant.

***Rabi* 2012**

Available N content in soil was significantly influenced in the post-harvest soils due to the application of N and S levels. Their interaction effect was also found significant. Soil available S in the post-harvest soils was significantly influenced by the various levels of N and S. N x S interaction effects also influenced significantly.

Sulphur uptake by safflower shoot at flowering stage showed significant influence because of various levels of N application. N x S interaction effect was also found significant.

At flowering stage dry matter accumulation of safflower (cv. PBNS-12) shoot was significantly influenced by the various levels of N and S as well as their interaction effect was also found to be significant.

Uptake of N by safflower shoot at flowering stage was significantly influenced by the various levels of N and S. Their interaction effect was also found significant.

Dry matter yield of safflower shoot at harvest stage was significantly influenced by the various levels of N application and interaction effects of N x S was also observed.

Uptake of N by safflower shoot at harvest showed significant influence due to the various levels of N application. N x S interaction was also found significant. However, S levels did not showed any effect.

***Rabi* 2013**

In post-harvest soil samples the available N and S content showed significant influence due to the application of various levels of N and S. Their interaction effect was also found significant. Soil available P showed significant effect because of different levels of N application, however, S levels did not showed any influence. Interaction effect of N x S was also found significant.

Dry matter accumulation by safflower (cv. PBNS-12) shoot at flowering stage was influenced by the application of various levels of N only. Interaction effect of N x S was found statistically significant.

Uptake of N, P, K and S by safflower (cv. PBNS-12) shoot at flowering stage was influenced by the application of various levels of N only. Interaction effect of N x S was found statistically significant.

Safflower (cv. PBNS-12) drymatter yield at harvest stage was significantly influenced by the various doses of N and S. Their interaction effects were also found significant.

Uptake of N, P, K and S by safflower drymatter at harvest stage was significantly influenced by the various doses of N and S applied. Their interaction effects were also found significant.

Uptake of N, P and S by safflower drymatter at harvest stage was significantly influenced by the various doses of N and S applied. Their interaction effects were also found significant. However, K uptake was significantly influenced by the application of various levels of N and N x S interaction effect was also found significant.