1000-grain weight of maize under urd-bean and soybean intercropping than sole maize.

Urd bean is one of the most important pulse crops. It has the potentiality to contribute on a large scale to the pulse production in India. Urdbean being a short statured legume crop with short duration and fast growing in nature, can find place in many intercropping systems (Sharma et al., 1988). One or two rows of urd bean can profitably be raised between two rows of maize. Many other workers (Willey and Osiru, 1972) also reported that the association of a short growing grain legume with a tall cereal is common and there is evidence that such intercropping system give higher productivity than corresponding sole crops.

Globally, India is the largest producer of pulses (15.23 million tonnes), however, its productivity is only 673 kg ha⁻¹. The per capita consumption of pulses in India decreased from 69 g day⁻¹ during 1961 to 36 g day⁻¹ as on now. This is due to poor growth rate in production of pulses compared with the population growth. With an estimate, India needs 29.30 million tonnes of pulses by 2020 with a productivity of 1,172 kg ha⁻¹ (Ali and Agrawal, 2004). This target can be achieved either by bringing more are a under pulses or by enhancing the productivity per unit area and/or combination of both.

Urd crop can be taken alone or as inter crop/mixed crop with widely spaced crops like spring plated sugarcane, maize, pearl millet etc. But generally the combination with maize crop is more prominent because of the short duration of both the crops and both the crops take advantages from each other, due to wider spacing. Weeds can be controlled in maize by taking urd intercropping and

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maize also be benefited by completing its N requirement from the N-fixation by the urd crop. On the other hand urd will be benefited by reducing the vegetative growth in intercropping. In both the crops water requirement can be met out from the rain but in poor soils naturally will require the proper nutrition for both the crops. To day onwards, a major issue would be the sustainable agriculture system to maintain and enhance soil productivity through an appropriate application of plant nutrients. The low input, sustainable agriculture and reduced chemical input concepts, which focus on the reconsideration of agricultural practices, used as crop residues incorporation, green manuring, FYM and bio-fertilizer use and inclusion of legumes in crop rotation will be important to maintain soil organic matter at an adequate level and to sustain reasonable productivity (Kirchner et al., 1993 and Grubinger, 1992).

Thus, for higher productivity and improvement in soil fertility for longer period, integrated plant nutrient management system (IPNS) has become important. The basic concept of IPNS is the promotion and maintenance of soil fertility for sustaining crop productivity through optimizing all possible resources like organic, inorganic and biological in an integrated manure appropriate to each farming situation and its ecological, soil and economic possibilities. The principal aim of IPNS is efficient and judicious use of all the major sources of plant nutrients in a integrated manure, so as to get maximum economic yield without any deleterious effects on physico-chemical and biological properties of the soil.

The IPNS package should include the fertilizer application as per recommendations of the soil test along with organic manure (FYM, crop residues and bio-fertilizers, Azotobacter, PSB and VAM). Pandey et al. (1999) observed that crop residue incorporation is
one of the important constituents to increase the efficacy of applied fertilizers. FYM and crop residues incorporated in soil affects in three ways, firstly it benefits the soil nutritionally through its effects on soil nutrients (macro and micro) and maintenance of organic matter. Secondly, it improves the physical health of the soil through its effects on BD, aggregate stability, infiltration rate (Bhatia and Shukla, 1982), and thirdly, enhances soil biologically through its effects on microbial decomposition and in turn the production of microbial biomass. So, it can be expected that proper management of crop residues along with the mineral fertilizer probably can sustain agricultural production under irrigated situations.

*Azotosbactor* and *Azospirillum* are the dominant among the free-livings forms of nitrogen fixers. Inoculation of seeds of different crops with efficient strains of *Azotosbactor* have been extensively as a production technology in many countries and find 20-29 per cent increase in yield (Mishra et al., 1998). Phosphorus solubilizing bacteria (PSB) like *Bacillus substithis*, *Pseudomonas striata*, *Pseudomons fluoresscence* are known to convert the fixed form of phosphorus into ionic available forms. The production of organic acids such as citric acid, fumaric acid, malic acid, melanic acid reduce the pH in their vicinity to bring about solubilization of phosphorus in soil (Banic and Day, 1982).

Integrated plant nutrient supply system and its management can improve the productivity of the intercrop of maize + black gram and will also improve the fertility level of soil. However, systematic/scientific research findings are meager on several aspects of IPNS in maize + urd intercropping. Therefore, the present study entitled “Studies on integrated plant nutrient supply (IPNS)
for maize intercropped with black gram was undertaken with the following objectives:

1. Identification and appraisal of suitable sources of plant nutrients for maize plus black gram intercropping system.

2. To study the available nutrients status after crop harvest.

3. To evaluate IPNS recommendations for maize yield, quality, soil and plant health and fertilizer use efficiency.

4. To formulate recommendations of IPNS for maize + black gram intercropping.