Effect of intercropping on increase yield

Sara Najafi¹, Abbas Keshtehgar²

1. The former student of agronomy, University of Zabol, Iran
2. Young Researchers and Elite Club, Zahedan Branch, Islamic Azad University, Zahedan, Iran

Corresponding Author email: Saranajafi66@gmail.com

ABSTRACT: Food supply is one of the most important problems the world is enduring nowadays; intercropping is used in many parts of the world for the production of food and feed crops. Intercropping is one of the most common practices used in sustainable agricultural systems which have an important role in increasing the productivity and stability of yield in order to improve resource utilization and environmental factors. Intercropping legumes and non-legumes is an agricultural practice of cultivating two or more crops in the same place of land at the same time which is commonly practiced in many parts of the world in order to increase the productivity per unit area of the land. The main theme of intercropping is to augment the total productivity per unit area and time, besides judicious and equitable utilization of land resources and farming inputs including labour.

Key words: advantage, radiation interception, yield stability

INTRODUCTION

In developing countries, the agricultural development is facing by several constraints concerned with limitation of soil, water and inputs, associated with continuous growth population, resulting in reduced production per capita. In addition, the farmers are frequently followed easy and old practices such as the relay sowing of crops, exhausting more land area, water and inputs. Moreover, this practice is commonly used for the principle crops which occupied most of the available old land area in Nile Valley, while other crops, of secondary importance, such as barley, lupin and chickpea are restricted in small areas (Bult. of Agric Econ. 2008). Food supply is one of the most important problems the world is enduring nowadays; intercropping is used in many parts of the world for the production of food and feed crops (Carruthers et al., 2000). Intercropping is one of the most common practices used in sustainable agricultural systems which have an important role in increasing the productivity and stability of yield in order to improve resource utilization and environmental factors (Alizadeh et al., 2010). Intercropping legumes and non-legumes is an agricultural practice of cultivating two or more crops in the same place of land at the same time which is commonly practiced in many parts of the world in order to increase the productivity per unit area of the land (Bhupinder et al., 2003). Rahimi et al. (2003) reported that LER in intercropping is higher than monoculture intercropped corn and soybean. They also introduced corn as the dominant species in most treatments. The crops are not necessarily sown at the same time and their harvest time may be quite different, but they are usually simultaneously grown for significant growing periods (Willey, 1990). Research in different countries reveals that in addition to increasing the ecological and economic diversity, intercropping brings an increase in production or yield benefits, more efficient use of water resources, land, nutrients and labors, reduction in problems caused by pests, diseases and weeds (Awal et al., 2006). Regarding to increasing growth of the world population, demolition and overthrown of ecological balance of the systems, it is of a great importance to increase agricultural products and environmental preservation. Variety of methods have been developed and used to achieve high production rates including technological and genetic methods, and chemical fertilizers and herbicides; but use of such methodologies has helped us only partly in order to meet our needs in the area so food production has to be considered along with environmental conservation (Sharifi, 2006). According to Campbell (1990) intercropping promotes diversification and allow greater flexibility in adjusting to short and long terms changes in the production and marketing situations. Intercropping provides better weed control and reduces pest and disease incidence (Finney, 1990). Intercropping may also lead to increased production per unit area per unit time without affecting the yield of main crop to a greater extent. When legumes are used as intercrops, they provide the beneficial effect on soil fertility by fixing atmospheric nitrogen. Best utilization of nutrients, moisture, space and solar energy can be derived through mixed intercropping system (Aiyer, 1963; Donald, 1963 and
Francis and Heichel, 1973). Furthermore intercropping is a popular cropping system among small scale farmers in the tropics (Vandermeer, 1989). Cereal/legume intercropping increased dry matter production and grain yield more than their monocultures. Nitrogen transfer from legume to cereal increased the cropping system’s yield and efficiency of nitrogen use (Fujita et al., 1992). Compared with corresponding sole crops, yield advantages have been recorded in many C4 cereal/legume intercropping systems, including maize/soybean (Metwally, 1978 and Mohamed and Nigem, 1988 and Ghaffarzaach, et al, 1994), maize/faba bean (Li, et al, 1999) and sorghum/soybean (Elmore and Jakobs, 1986 and Ghosh, et al, 2009). But little and recent research works have been done using C3 cereals instead of C4 ones, for intercropping with legume and got similar yield advantages, including, wheat/field bean (Haymes and Lee, 1999) barley/pea (Hauggaard-Nielsen and Jensen, 2001), barley/faba bean (Trydemonkundsen, et al, 2004) and wheat/chickpea (Banik, et al, 2006). The main theme of intercropping is to augment the total productivity per unit area and time, besides judicious and equitable utilization of land resources and farming inputs including labour etc. (Marer et al., 2007).

**Some advantages intercropping**

Many concepts have been developed to assess yield advantages as a result of the divergent production goals of different intercropping systems which include; land equivalent ratio (LER) and relative yield total (RYT) (Willey, 1990). Intercropping of cereals with legumes has been popular in humid tropical environments (Tusbo et al., 2005) and rain-fed areas of the world (Gosh et al., 2004) due to its advantages for yield increment, weed control (Poggio, 2005), insurance against crop failure, low cost of production and high monetary returns to the farmers (Ofori and Stern, 1987), improvement of soil fertility through the addition of nitrogen by fixation and transferring from the legume to the cereal (Gosh et al., 2006), improving yield stability, socio-economic and some other advantages (Willey, 1979). Intercropping being an agricultural practice can be used for decreasing the dependency on chemical herbicides in weed control (Banik et al., 2006) and defined as the growing of two or more crop species simultaneously in the same field during a growing season (Ofori and Stern, 1987). Intercropping generates beneficial biological interactions between crops, increases grain yield and stability, helps use the available resources more efficiently and reduces the weed pressure (Jensen, 2007). The intercropping may lead to an overall yield advantage (Sayed Galal et al., 1979; Ahmed and Rao, 1982; Sayed Galal, 1983 & 1984; Assey et al., 1992a&b; Shafik, 1995&2000; Metwally, 1999 and Shafik and Soliman, 1999).

**Transfer fixed N to intercropped cereals**

Intercropping of cereal and legume crops helps maintain and improve soil fertility. Legumes fix atmospheric nitrogen, which may be utilized by the host plant or may be excreted from the nodules into the soil and be used by other plants growing nearby (Andrew, 1979). Legumes can transfer fixed N to intercropped cereals during their joint growing period and this N is an important resource for the cereals (Shen and Chu, 2004). Soil mineral N contents are often higher after grain legumes than after cereals (Chalk, 1998).

**Radiation interception and moisture use**

Light, water and nutrients may be more completely absorbed and converted to crop biomass by intercropping, which is the simultaneous growing of two or more crop species in the same field. This is a result of differences in competitive ability for growth factors between intercrop components (Anil et al., 1998; Amini et al., 2013). Solar radiation is the major resource determining growth and yield of component crops of intercrops when other growth resources are not limiting. Canopy structure is not only essential to describe radiation interception but also precipitation interception, evapotranspiration and crop productivity. Improved productivity can result from greater interception of solar radiation, higher light use efficiency, or a combination of the two (Willey, 1990). Arya and Niranjan (1995) indicated that maximum moisture of 10.4 per cent was recorded under sorghum + fodder cowpea with a farm yard manure 6 tons per ha, followed by sorghum + fodder cowpea with 50 per cent inorganic fertilizer (N 30 + P 8.8 kg/ha). Integration of legume either in sole or in the intercropping systems has the potentiality to extract more moisture from deeper soil surface.

**Improve yield stability**

Intercrop systems may improve yield stability, allowing more consistent yields (Willey, 1979; Horwith, 1985; Fukai and Trenbath, 1993), and efficient use of the resources, allowing reductions in costly inputs (Keatings and Carberry, 1993; Morris and Garrity, 1993ab).
Strip intercropping

Between different intercropping methods the strip intercropping is considered an efficient method for massive field culture and production that if administered well permits use of machinery and mechanization in cropping, maintenance and harvesting and therefore increases economical potential and decreases use of fertilizes and insecticide and diminishes soil erosion especially in slopes (Cruse, 1992; Hayder et al., 2003). In the strip intercropping different plant are sewed in strips but in the same field. Strip width has to be set in a way that easy mechanization and plant interactions are achieved. This intercropping methodology is common in most of developed countries and leads to a higher yield stability, soil fertility and decreased nutrients loss along with decreased pests and weeds and plant diseases (Hauggaard-Nielsen et al., 2007; Marchiol et al., 1992; Leosing and Francis, 1999).

MATERIALS AND METHODS

This paper is a review of the literature search on ISI, Scopus and the Information Center of Jahad and MAGIRAN, SISID is also abundant. Search library collection of books, reports, proceedings of the Congress was also performed. All efforts have been made to review articles and abstracts related to internal and external validity.

REFERENCES

ARYA RL, NIRANJAN KP. 1995. productivity of sorghum (Sorghum bicolor) as affected by legume intercropping under different fertility systems. Indian Journal of Agricultural Sciences, 65 : 175-177.


Marer SB, Lingaraju BS, Shashidhara GB. 2007. Productivity and economics of maize and pigeonpea intercropping under rainfed conditions in northern transitional zone of Karnataka.


