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Dr. Hichem Ben Salem is the Director of ICARDA's Research Program entitled "Diversification and Sustainable Intensification of Production Systems". Before joining ICARDA on 1 January 2014, Dr Ben Salem was the Director General of the National Agricultural Research Institute of Tunisia (INRAT) for the period 2011–2013, and at the same time he was the Head of the Laboratory of Animal and Forage Production at INRAT since 2006. At the international level, Dr. Ben Salem is Coordinator of FAO-CIHEAM Network on Sheep and Goat Nutrition since 2000, and also Coordinator of a research theme "Cactus: Forage, Rangeland and Environmental Protection" under the FAO-ICARDA Cactus Network for more than 10 years. Dr. Ben Salem obtained a PhD in Animal Nutrition from the University of Bourgogne (Dijon-France) in 1998. Former Director of Research in Animal Nutrition at INRAT, and along with his career at this Institute he was in charge of a research program focusing on the potential use of alternative feed resources (fodder shrubs, crop residues, agro industrial byproducts) in sheep and goat feeding. He also investigated livestock response to different stressors (anti-nutritive factors in the diet, drinking water restriction or salinity) in terms of digestion, production performances and meat and milk quality. He had been in touch with farmers and people for long time through different Research For Development (R4D) projects targeting income increase and empowerment of pastoral and agro-pastoral communities in different arid and semiarid regions of Tunisia. Dr. Ben Salem published around 100 papers mainly in international peer-reviewed journals and book chapters. He was also an invited editor of several special issues of Elsevier journals.

Presentation Title: Conservation Agriculture Holds Considerable Promise to Help Agricultural Livelihood Systems Coping with Climate Change: ICARDA's Experience

Presentation Abstract:

Around one-third of the global population depends on dryland agriculture for food security and livelihoods. In addition to common challenges (such as natural resources degradation, poverty), climate change is exacerbating the situation. Therefore,
cost-effective and environment-friendly options that could improve the efficiency and the sustainability of agricultural livelihood systems have to be developed. Agricultural farming under Conservation Agriculture (CA) holds considerable promise to help farmers cope with climate change and to improve their incomes. CA is spread over 155 million ha, 24% of which had been achieved during the past four years. It is based on three main principles: i) No, or minimum soil disturbance, ii) Soil cover, and iii) Crop diversity. CA is potentially applicable in most agroecosystems and CA is being recognized more widely as an approach for sustainable production intensification that offers enhancement of productivity with improved resilience and climate change adaptability and mitigation. It promotes resilience to climate change by increasing water availability to the crop and rooting depth. Indeed, CA alters water balance in the short- and long-term through decreased soil and water evaporation and increased infiltration rate, soil water holding capacity and aggregate stability.

ICARDA's investigations into CA started in 2000, first in Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan), and then extended to North Africa (Algeria, Morocco and Tunisia), West Asia (mainly Iraq, Jordan, Syria) and South Asia (mainly Bangladesh, India and Nepal). Cropping areas under CA are rapidly and substantially increasing in the above-mentioned countries, and many other countries in these and other regions are interested to adopt CA. Different production systems in these regions (Agropastoral, rain-fed-based, food legumes-based systems) are hosting CA long-term experiments conducted under

the framework of the ACIAR project in Iraq and Syria showed that the elimination of pre–sowing tillage operations permitted sowing soon after the first autumn rains (about 4–6 weeks earlier than normal) which boosted water-use efficiency and crop production by 12%–20%. A lack of suitable Zero Tillage (ZT) seeders was a major obstacle to adoption, so ZT engineering expertise was employed to enhance the knowledge and skills of local workshops. Participatory CA extension programs were established, which promoted considerable adoption in both Syria and Iraq, 30,000 ha and 15,000 ha, respectively. Surveys in both countries showed that farmers who adopted ZT reduced their costs of poduction and increased crop productivity, even though most did not change their cereal-dominated crop rotations, or grazing of crop residues.

Due to the success of the above project, two other ICARDA projects focusing primarily on CA were implemented. ACIAR funded a second project to promote CA in Algeria, Morocco, and Tunisia (2012–2015) using a similar approach. While CA proved efficient in cereal-based systems, the question arose as to whether it could enhance crop-livestock systems where stubble grazing is considered important to fill the feed gap in summer and early autumn. The question of how much stubble the animals could consume without impacting subsequent crop production is not well documented. Therefore, ICARDA, through an IFAD grant, is instigating a project focusing on crop-livestock interactions in CA systems in Algeria, Tajikistan, and Tunisia (2013–2015). ICARDA's objective is to seek the commitment of donors to scale-up CA in the dry areas. The various projects developing CA which were implemented by ICARDA in Central Asia were effective at promoting adoption of ZT in Kazakhstan and Uzbekistan, which is expanded on

2.1 million ha and 0.6 million ha in these respective two countries. It is concluded that CA can promote climate resilience by increasing water availability at critical growth stages of crops. It is seen as a promising option for sustainable intensification. Tradeoffs between CA and integrated crop livestock, mainly at the level of small farmers, have to be identified.