1: Technology Factsheets from Agriculture

Name of Technology	**Conservation Agriculture**
Sector	**Agriculture and Food Security**
Sub-Sector	**Agriculture**
Introduction	Conservation agriculture is an agriculture system that aims at soil and water conservation, nutrient improvement and enhanced production. Conservative agriculture technologies are based on the principles of (a) minimal soil disturbance (zero-tillage), (b) maintenance of good soil cover (cover crops, residues and mulches), and (c) appropriate crop rotation or crop association depending on the availability of land. Consequently soil organic matter is conserved, water retention is increased, erosion and pollution are reduced, and the productivity of agricultural systems is increased even during the prevalence of drier climate phenomena such as droughts. Therefore, food security is assured during hungry periods especially in arid and semi-arid climatic conditions familiar to The Gambia.
Technology characteristics	Zero tillage is a method of plowing or tilling a field in which the soil is disturbed as little as possible –the plant seed is sown directly into the seed bed. Zero tillage aims at making better use of agricultural resources through the integrated management of soil, water and biological inputs. Zero Tillage improves the soil, increases production and decreases the cost of production. It consists of improved agricultural packages including (a) crop residue from previous crop and crop rotation; (b) application of herbicide for control of emerging and non emerging weeds (pre-post emergence herbicides); (c) planting in rows and application of fertilizer in one operation by a special planter; and (d) starting agricultural operations after the soil has received 110 mm of rainfall. The Conservation Agriculture (CA) approach is recommended as a climate-resilient agricultural technique because conservation of soil organic matter increases the fertility and water-holding capacity of soils. This simple and cost-effective approach to increasing the climate resilience of agriculture is particularly well suited to low-input rain-fed agricultural systems such as those in The Gambia. The CA approach is compatible with the use of green manures i.e. the use of plant material to increase soil fertility. Intercropping involves planting two or more crops in close association, often focusing on nitrogen-fixing species. This approach can increase the climate-resilience of agriculture by diversifying the risk of monoculture farming, as well as by increasing soil fertility through planting of nitrogen-fixing crops.
Costs, including cost to implement adaptation options	Conservative Agriculture is less expensive in terms of capital cost (for machinery), in labor and energy than conventional agriculture. Costs associated with establishment of one production unit using zero tillage equipment (tractor, 90HP+planter+ sprayer) is 31,600 USD; In field crops, the cost of implementing the technology is reduced to the cost of the seeder or planter (2000$). Cost of cultivating of one hectare by traditional method = 40 USD Cost of cultivation of one hectare by zero tillage method = 54 USD The production of one hectare using traditional system is 700kgs (7 sacks where 1 sack of crop = 100kg). The production of one hectare by zero tillage is 2,300kgs (23 sacks where 1 sack of crop = 100kg).
Additional cost to implement adaptation technology compared to "business as usual"	When compared to business as usual, there is no additional cost rather than a reduction by 350$/ha at least (cost of land preparation). ***Examples of typical long term cost (i.e. 10, 30, or 50 years) without adaptation*** • Olives: annual plowing will cost 650$/ha • Cereals (cost of production of a monoculture with till): 1200$/ha ***Examples of typical long term cost (i.e. 10, 30, or 50 years) with adaptation*** • Olive: first year: 160$/ha (green cover seeds and herbicide), then 30$/ha starting the second year. • Cereals: (barley-vetch rotation with not till): 800$/ha
Operation and maintenance:	Application of conservative agriculture technologies requires the use of specific seed machinery for seeding and sufficient large areas to adopt crop rotation (namely for cereals and legumes). To maintain soil fertility agriculture residues should not be removed. Training is required for technicians and farmers.
Potential development impacts, benefits	Zero tillage improves the productivity in rain-fed and irrigated farming systems. A fundamental criterion related to coverage is that annual rainfall must exceed 600mm. Thus, the targeted area for transfer and application of the zero tillage system is geographically large for The Gambia as rainfall is everywhere equal to or greater than 600mm. Application of conservative agriculture technologies shows that the cost of production is maintained as the inputs do not augment because soil fertility and water content are preserved. The major saving will be in terms of costs for tillage and land preparation for plantation. Production is sustained with minimal annual variation.
Economic	Adoption of conservative agriculture as an adaptation technology will enhance the attainment of farmers' needs as well as the development priorities of the country, particularly food security and poverty alleviation. There will be new job opportunities, increase of farmers' incomes, increased food production and encouragement of private sector investments in production of agricultural crops. An overall yield stability, a reduction in cost of production, and increases in farmer's income are relized. Revenue is increases of about

	760$/ha for cereal have been registered.
Social	The social benefits of zero tillage include improvement of living standards, upgrading the livelihood skills of farmers and enhancing their resilience to climatic and external economic shocks. Health status of communities will improve.
Environmental	Soil is preserved from the impact of climatic adverse (wind, rain, solar radiation) and evaporation is reduced, which increases soil water content and soil organic matter. Preservation of soil due to zero tillage reduces greenhouse gas emissions. Water retention and slowed surface runoff increases chances of the maintenence of soil cover, enhanced biodiversity in the soil, reduced desertification and resilience to floods.
Status	Zero tillage, a component of Conservative Agriculture, was applied in The Gambia on a relatively small scale in the 1980s and 1990s. However, due to increased human and animal population, reduction in productivity due to negative impacts of climate variability which is now compounded by climate change, the need to grow and produce more food in a shorter period arose. Agricultural mechanization was introduced which has negative impacts on the shallow and poor soils of The Gambia. Productivity continues to decline and there is need to go back to conservative agriculture.
Barriers	Opportunities include: • Potential reversal of declining unit area productivity through investment in zero tillage in the rain fed areas. • Application of Zero Tillage minimizes weeds and improves soil structure over long periods, leading to a decrease in the cost of production. • Adapting conservation agriculture to some crops may require specific machinery for seeding. • Conservation agriculture is suitable for arid and semi arid regions, to areas with soils suffering from low organic matter content and for areas prone to desertification Barriers include: • The application cost of zero tillage is high. • Conservation agriculture should be avoided in soils with high clay content, in humid areas with shallow water table, in saline soils and for crops with no residues left. • Small holders are unable to apply economically viable crop rotations, and unable to access to machinery.
Acceptability to local stakeholders	Heavy machinery and intensive applications of artificial fertilizers are not suitable for the soil conditions of The Gambia. Hence, conservation agriculture is acceptable to farmers and agriculturalists alike.
Endorsement by experts	Conservation agriculture is widely acknowledged, endorsed and promoted by experts and extension agents of The Gambia.
Timeframe	Conservation agriculture needs medium and longe-term applications for sustainble outcomes.
Institutional and organizational requirements and capacity development	Institutional capacity development and maintenance are prerequisite activities to adopt the technology. Training and skills development of agriculturalists, farmers, private and business sector entities and other stakeholders in the adoption and application of technologies of zero tillage (planting, spraying and application of fertilizer) are paramount. For wide acceptance and applications of the technologies, more research and trials should be conducted in different admnistrative regions and agriculture zones of The Gambia.
Adequacy for current climate	Conservation agriculture is valid and adequate under curret climate variability and change in The Gambia becuase of its semi-arid conditions and can have a role in reducing GHG emissions.
Size of beneficiaries group	Conservation agriculture can be adopted by all farmers in The Gambia.
Market potential	Products of conservation agriculture are more environmental friendly and with lesser pesticide residues. They, therefore have higher competitive potential on the market.