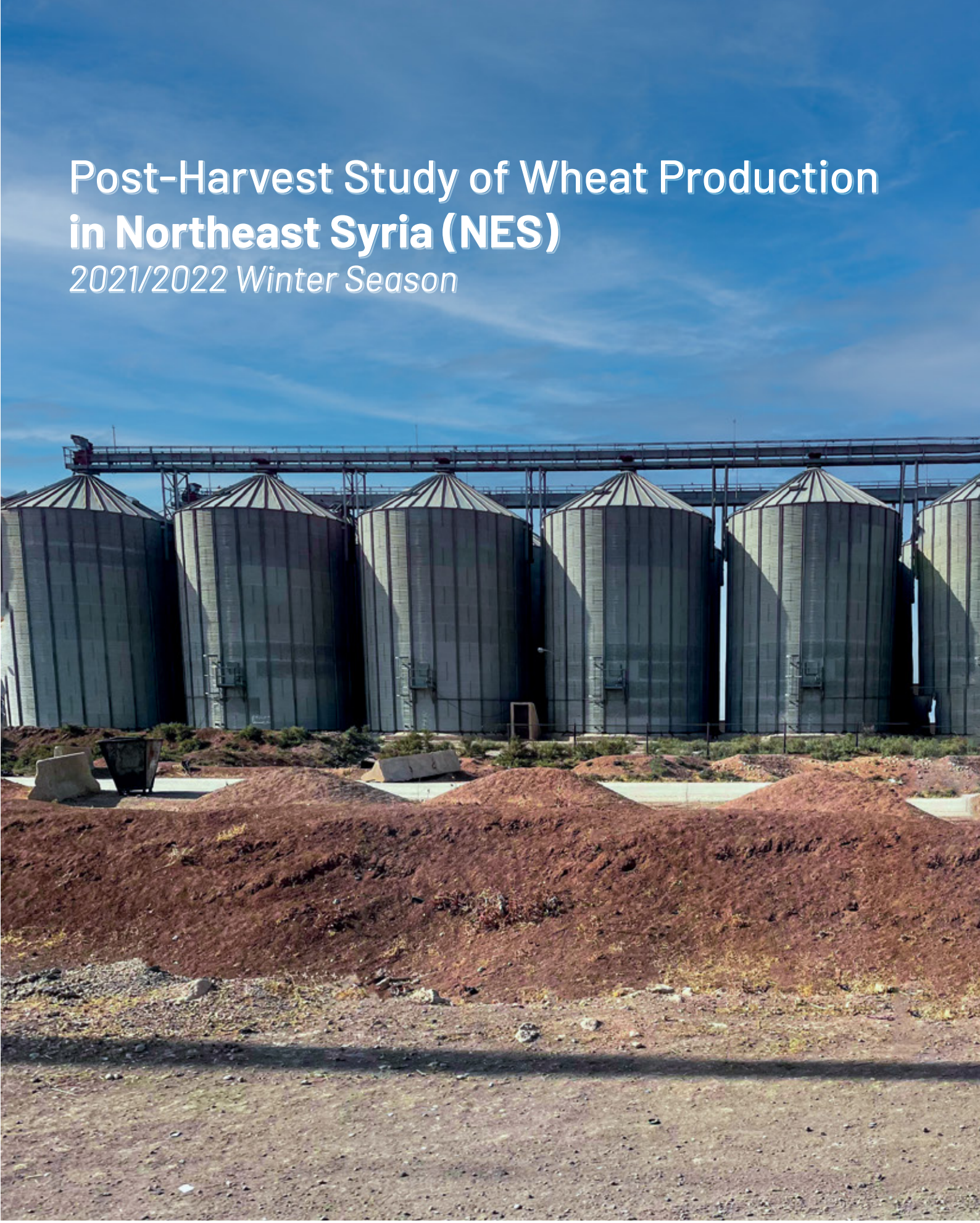
Post-Harvest Study of Wheat Production **in Northeast Syria (NES)**

2021/2022 Winter Season



North East Syria (NES)
FOOD SECURITY & LIVELIHOODS
Agriculture Working Group

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iMMAP

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Cover Photo: Leena Al Halig, Amuda, Al-Hasakeh, October 2022

1. Introduction

Wheat-based foods have been staple foods since about 10,000 years and constitute a major source of energy, dietary fiber, and micronutrients for the world population. Wheat bread in particular, has been referred to as the stuff of life and is considered a fundamental diet element for hundreds of millions around the world. In fact, the significance of wheat worldwide as the main food can be perceived by stylized wheat spike in the logo of the Food and Agriculture Organization of the United Nation. Syria is a country that heavily relies on wheat to feed its population; in fact, wheat is considered a strategic crop strongly influencing food security. This study assessed the post-wheat production season of 2021/2022 in northeast Syria (NES), considering the dynamics that have occurred in the agricultural sector in this region during the prevailing crisis and related natural disasters of climate-induced aridity. Furthermore, a post-harvest assessment of wheat production of 2021/2022 aimed to inform farmers, local authorities, market actors, humanitarian partners and other relevant stakeholders to evaluate what went wrong (or right) during the previous cropping year and inform their wheat cropping plans for the subsequent winter wheat cropping year of 2022/2023 and beyond. The assessment was based on an understanding of all the activities and actors involved in the wheat production value chain, including the production inputs, the production process and the post-harvest handling practices of wheat grains including sales and distribution processes. Given the challenges that the agriculture sector and wheat farmers are facing as a result of water scarcity, low erratic rainfalls, and wheat harvest profit for farmers, the purpose of this report is to develop recommendations to improve wheat production and mitigate challenges and risks of losing production and profit. In that regard, the Food Security and Livelihood (FSL) Working Group in NES and iMMAP carried out a post-harvest assessment focusing on input supply chain management and the output market of wheat production in NES.

Specific study objectives

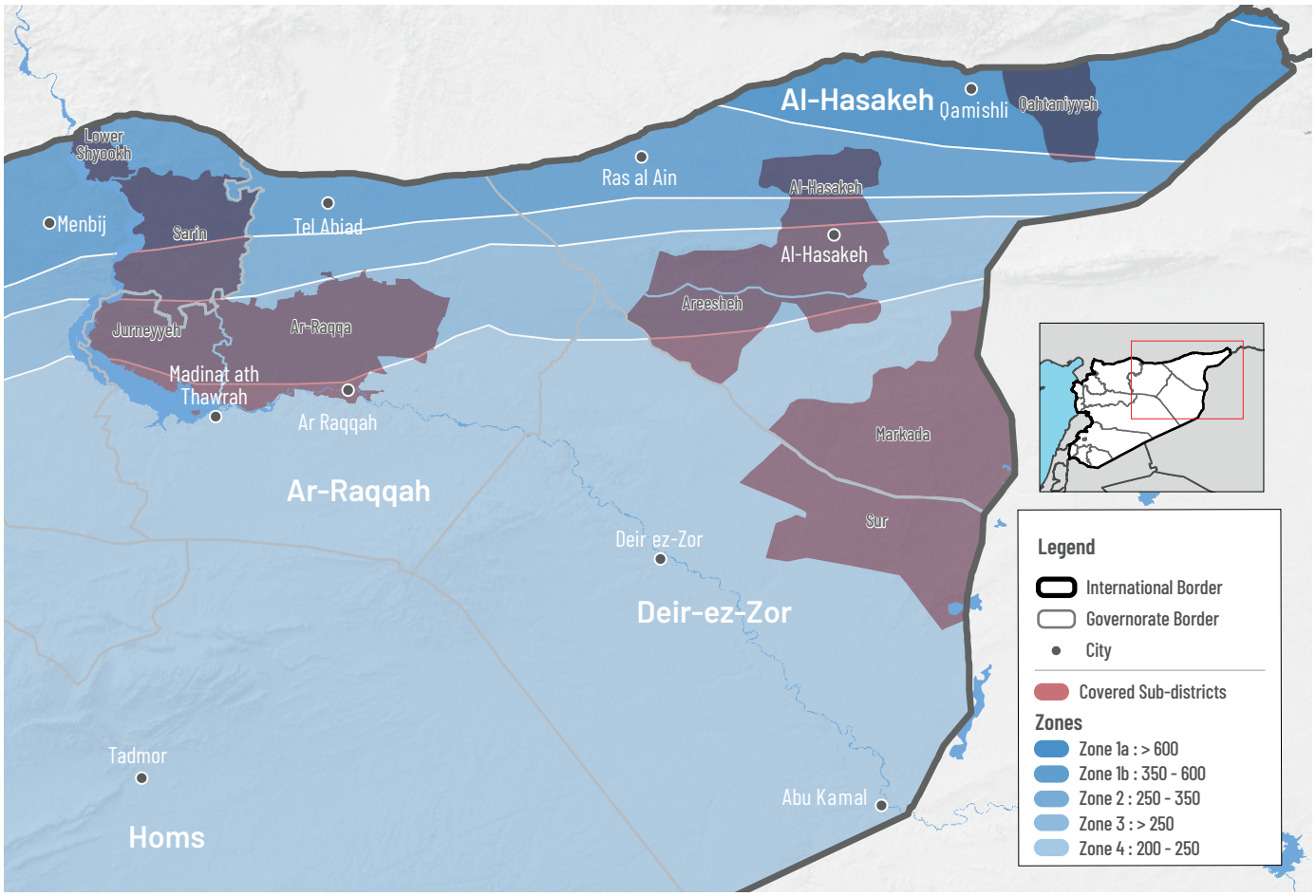
- Understand the current challenges and opportunities facing wheat crop producers in the NES region.
- Explore sources of wheat production inputs including agricultural land ownership, wheat seed, and other agricultural inputs (fertilizers, pesticides, herbicides, fuel, and agriculture extension service support ...etc.).
- Explore the wheat grain trading norms, and the effect on local wheat production.
- Understand opportunities and inefficiencies in the current system that are hindering market actors within the wheat value chain from sustaining their agribusiness and livelihood.
- Identify leverage points along the wheat value chain that have potential in strengthening the effectiveness and efficiency of local wheat production across the NES region.

Study Methodology

The study methodology implemented a mixed and participatory design comprising document literature reviews, sample-targeted key informant interviews covering 36 key expert informants selected from all the five agro ecological zones of NES across 9 subdistricts in the governorates of Aleppo, Deir-ez-Zor, Ar-Raqqa and Al-Hasakeh through FSL AWG partners (Map1) and local authority representatives. Two focus group discussions (FGD) were held with the Agriculture and Irrigation Authority and the Economic Commission of NES. Furthermore, remote sensing technique and field observation records were used to map agricultural land cover and overall yield data over the last five years. The use of a combination of techniques for this assessment was crucial to ensure good quality data while applying the post-harvest assessment-sensitive approach. The diversity in methods allowed triangulation to build on the intentional combination of multiple data collection techniques; the use of a variety of data sources to derive multiple perspectives and interpret data on how various factors influence wheat production in NES.

Data collection coverage map

Map 1: *Data collection coverage map, per sub district, per agro-ecological zone*



2. Study Findings

Agricultural Land Ownership

In commerce, there are three essential factors of production, namely, land, capital and labour. In 2011, the total area of wheat cultivated lands in NES region was around 775 thousand hectares[1], down to 675 thousand hectares in 2019[2]. In the 2021/2022 winter cropping season, one expert key informant estimated a decrease in the percentage of wheat cultivated lands to less than 50% of the total agricultural land in NES region. This was reportedly attributed to the diminishing returns of wheat production in NES. SANES stated that they increased the budget and support for farmers while focusing more on expanding irrigated areas by ensuring farmer support in providing necessary facilitations, as well as high quality seeds to be planted and sold exclusively to the Self Administration to ensure crop quality while the farmer guarantees crop sale.

At times, especially in low-production seasons, disputes between landowners and farmers occur over the percentage to be paid, which affects the viability and profitability of wheat production.

Furthermore, another key informant reported that, due to the division of inheritance among brothers, land property size per household is being reduced with the resultant implications of what is known as "economies of scale", meaning the advantages of the low cost of wheat production for large-scale land, are reduced. The total size of agricultural land properties in NES is also affected by access, with a few key informants pointing to the difficulty of accessing land near the front lines between the Syrian Defense Force (SDF) and Turkish forces in the areas of Zarkan, Tal Tamr, Ain Issa, and Tal Abyad. Turkey's incursion into Ras al-Ain has left about 400 thousand dunums of agricultural land out of the control of SANES and therefore unable to reach original farm owners.[3]

These study findings on land ownership for wheat production highlighted that some better-off farmers have a competitive advantage on the land issue, namely private ownership, large land, and a high percentage of irrigated land to rain-fed, while the nature of land ownership is a burden on other vulnerable farmers such as those who have a "taking possession" and must pay a proportion of their production to the original owners. To achieve equity in terms of land ownership of the means of production, the responsible parties can offer a competitive advantage to farmers whose ownership or form of land is disadvantaged through a fair and effective system of fees and taxes. For example, a specific levy on the share of wheat may be imposed on the landowners who do not work on it. The proceeds of such taxes are used to support the wheat farmers, especially those who own the land by "taking possession".

1 Ministry of Agriculture and Agrarian Reform: Agricultural Statistical Series 2011. Available at: http://www.moaar.gov.sy/site_ar/agristat/2011/2.pdf

2 Food Agriculture Organization and World Food Program (2019): "Special Report: FAO/WFP Crop and Food Security Assessment Mission to the Syrian Arab Republic." Available at: http://www.fao.org/3/ca5934en/ca5934en.pdf

3 https://impactres.org/reports/PolicyPapers/Wheat_production_value_chain_in_NES.pdf

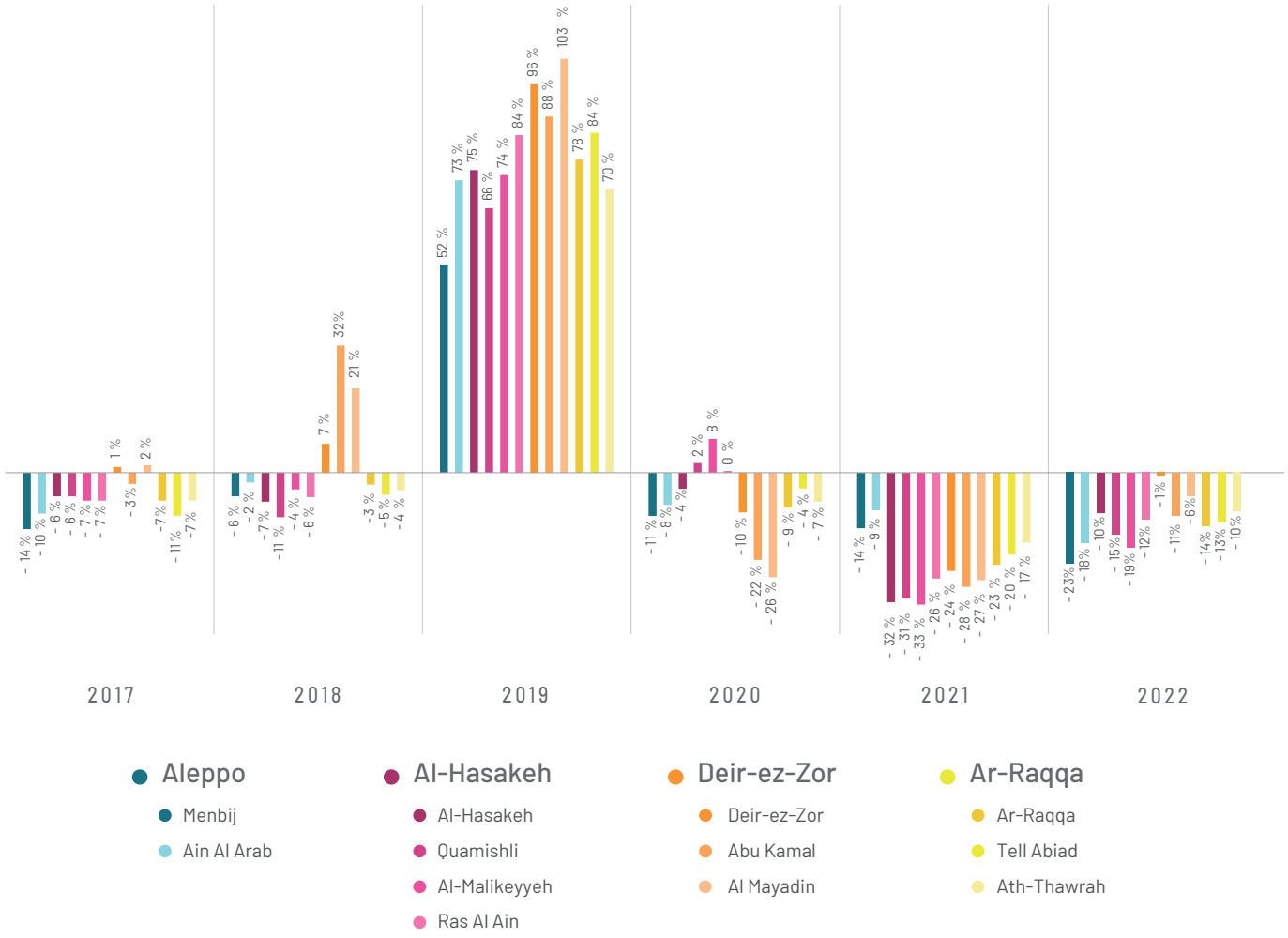
NES Water Crisis for Wheat Production

Low and erratic rainfall across NES coupled with massive declines in available water from cross-border water resources in Turkey flowing along the Euphrates River and the Alouk water station are currently negatively impacting wheat production. Yet, based on district-level rainfall statistics produced by Syria WFP VAM Seasonal Monitor[4] (Cumulative millimeters between September and April wheat growing season), there was a slight improvement in the rainfall levels for the 2021/2022 winter season compared to the previous season of 2020/2021. For instance, Al Hasakeh district growing season rainfall total recorded an improvement by (22%) compared to last season, however, this was still below long-term average by (-10%). Al-Malikkiyeh and Quamishli districts recorded an improvement of seasonal rainfall totals as well by (14%) and (16%) respectively. Furthermore, Ar-Raqqa and Deir Ez-Zor governorates recorded increase in annual rainfall by (20%) and (8%) respectively whereas Menbij and Ain Al-Arab districts recorded (9%) decline.

Despite the slight improvement in the annual rainfall amount of 2021/2022 compared to the previous season of 2020/2021, annual rainfall amount for 2021/2022 is still relatively poor in all NES governorates that has recorded a massive decline in rainfall level even when compared to the devastating drought year of 2018 (Figure 1). Compared to 2018, Al-Hasakeh governorate recorded rainfall reduction of (3-15%), most districts in NES had a percentage decrease. In Aleppo, Menbij district reported (27 mm) decrease compared to 2018 and Ain Al Arab district reported (34 mm) decrease in rainfall levels compared to 2018. Deir Ez Zor district reported an 8% decrease in rainfall levels, while Ar-Raqqa district reported (11%) decrease change in winter growing season (September-April) rainfall totals. Furthermore, temporal rainfall distribution was erratic with precipitation in March-April and deemed not sufficient for wheat grain formation and filling across NES. High temperatures exacerbated the impact of the moisture deficit on winter wheat crop production which was also affected by erratic precipitation during a crucial reproductive phase of the crop. Poor temporal distribution of rainfall during the season and its early cessation, coupled with a sharp increase in temperatures, contributed to the decline in wheat crop productivity in terms of quantity and quality. Rainfed wheat cultivated lands in the areas affected by erratic rainfall partially failed, while yields in other rainfed or in irrigated areas were also reduced due to poor rainfall amounts at grain filling stages.

4 WFP VAM. Dataviz Visualizations: Seasonal Explorer: Rainfall and Vegetation. dataviz.vam.wfp.org

Figure 1: *Percent Change in Winter Growing Season (Sep-Apr) Rainfall Totals in NES by District, 2017-2022*



** District Rainfall Totals and Long Term Averages from WFP VAM Seasonal Observer Database*
*** Rainfall Totals calculated as total rainfall over growing season: September-April*

Water crisis in Syria persisted particularly in NES, formally considered the breadbasket of the country, due to many factors such as low and erratic rainfall, severe drought conditions, damaged water infrastructure and the disruption of cross-border river flows from Turkey resulting in dramatic reductions downstream water availability in the Euphrates River basin including the Khabour River. In fact, Turkey and Syria have a long-standing dispute over the management of the Euphrates River; the tensions have worsened over the past several decades as average annual flows in the Euphrates at the Turkish–Syrian border have declined substantially since 1990, coinciding with both the completion of the Ataturk Dam and an apparent decrease in precipitation in both NES region and its upstream Euphrates River basin in Turkey. Data derived from the water level time series from Satellite Altimetry, Figure 2a, b presents the ever-declining water supply from the Tishreen and Assad (Tabqa) reservoirs, respectively. Reduced surface water availability also reduced hydroelectricity generation for the much-needed energy to power irrigation water systems and related machinery for wheat production. Tishreen and Tabqa dams are the primary sources of electricity for an estimated 3 million people. Reduction of electricity production has already caused electricity blackouts for farming communities across NES. These complex multi-factors causing water scarcity and poor supply of electricity in NES cause a massive decline in wheat production in the region. In Ar-Raqqa governorate, farmers were negatively affected by cutting off the waters of the Euphrates River in the landscape, by appointing irrigation hoses to connect them to the river, and the cost to assign the best riel and the debt over the season to cover these costs.

Figure 2: *Water level (m) from 2002-2022*

Figure 2 a: *Tishreen, Reservoir, water level (m) from 2018-2022*

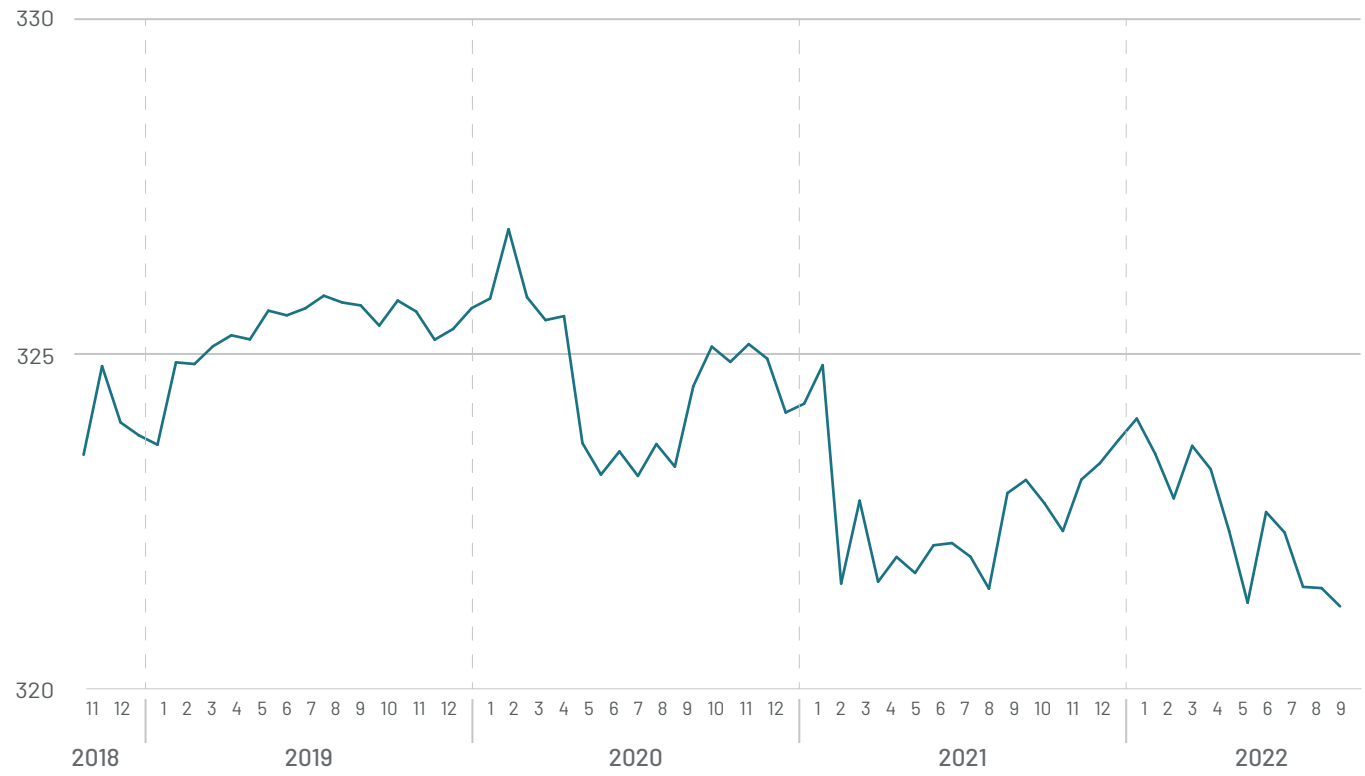
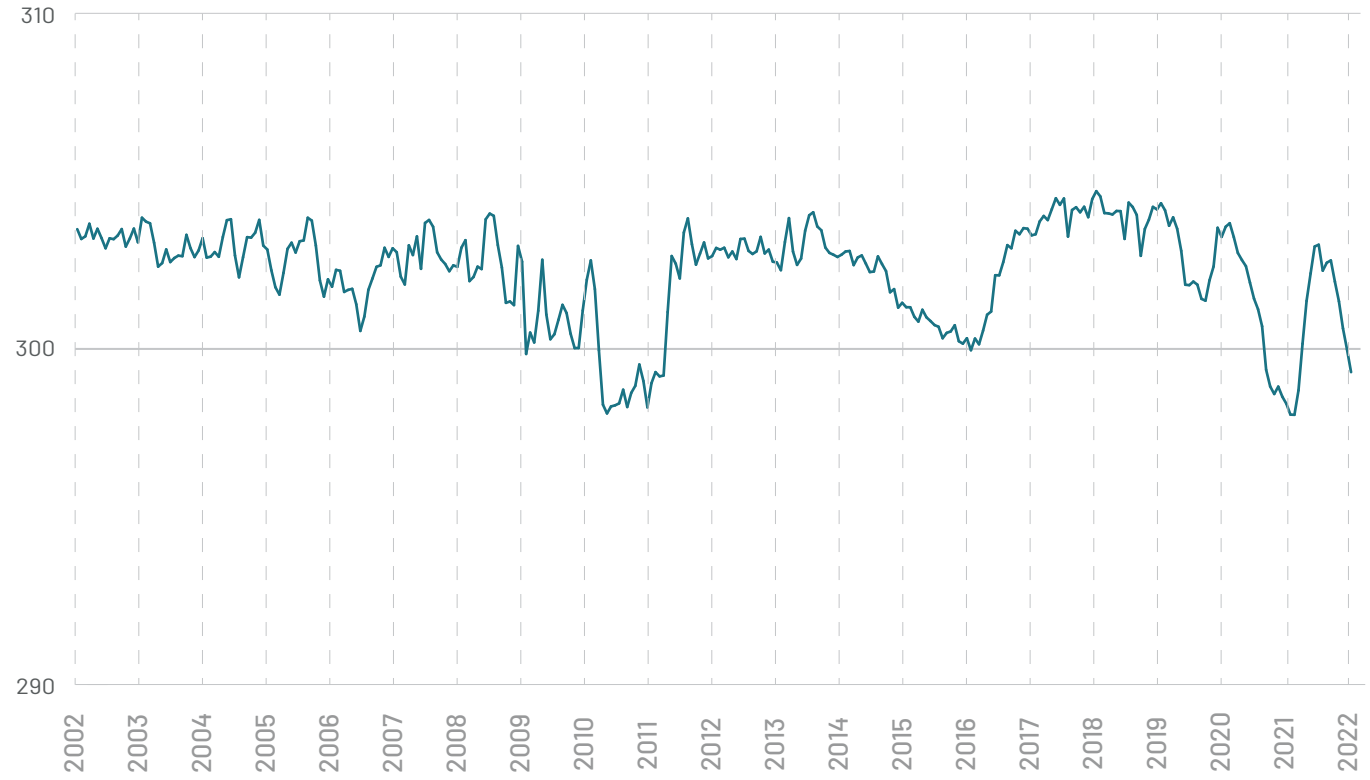


Figure 2 b: *Assad, Reservoir (Tabqa, Reservoir), water level (m) from 2002-2022*

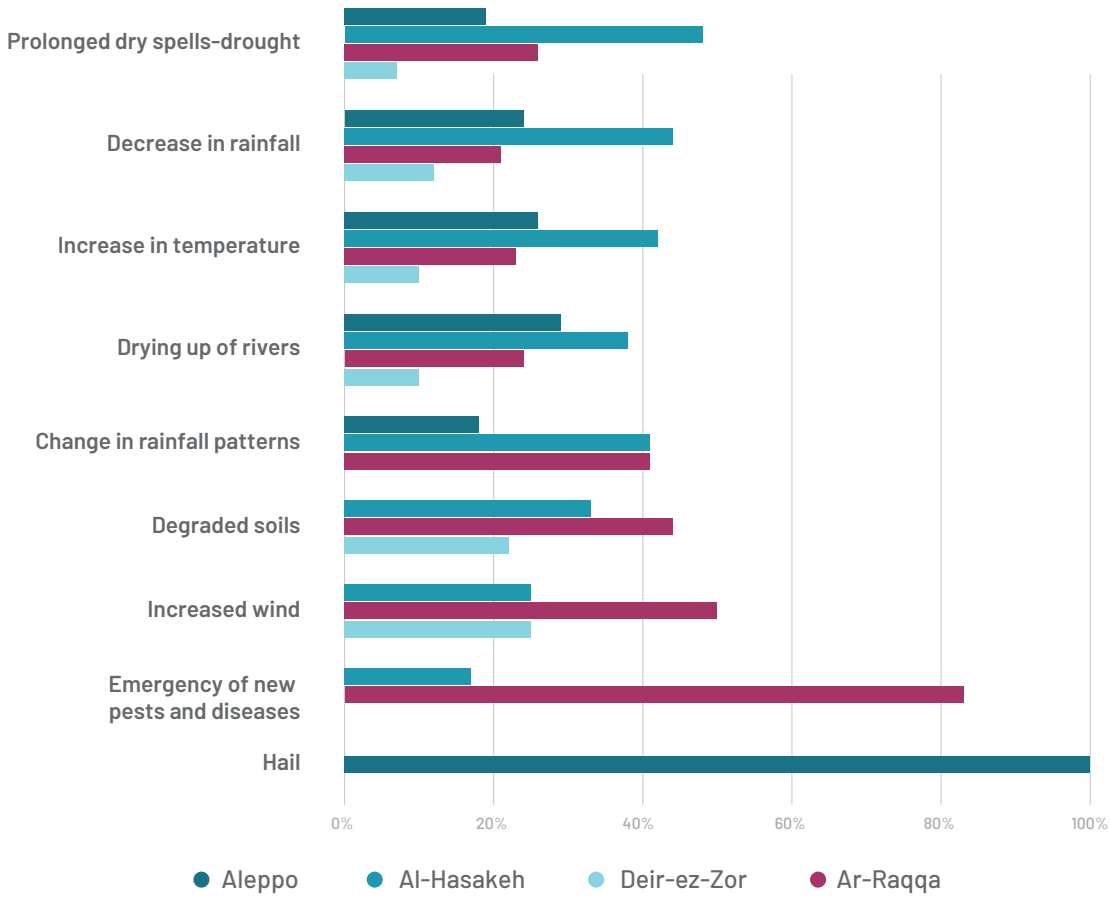


The Effects of Climate Change on Wheat Production in NES

One of the objectives of this study was to assess the perception of climate change risks on wheat farming across NES and its influence on farmers' adoption of climate-smart agriculture practices. Key informants and focus group discussion participants agreed that climate change was a reality and had witnessed changes within 5 years. In fact, they have reported that NES is experiencing higher temperatures, more erratic rainfall patterns with reduced annual rainfall and high frequency of prolonged dry spells causing drying up of rivers (sources of irrigation water)(Figure 3) that are consequently negatively impacting wheat production. Moreover, NES wheat farming could be facing new climate change risks such as hailstorms, sandstorms, and diseases/pest's outbreaks; a common pattern observed in similar areas affected by climate change. On another hand, SANES and the Agriculture and Economic department have put in place some regulations to control and reduce underground water use for irrigation as it poses a further risk on reducing groundwater levels that are detrimental to river basin discharge and drainage systems. Additionally, low groundwater levels can cause salinity that negatively affects wheat production.

Interviews with key informants, particularly service providers in the agriculture sector reported a growing perception of climate change predicament. Despite the emerging appreciation of climate change concern and its negative impact on agriculture production, there were still other farmers, who still held the belief that the area was humid with adequate rainfall from the winter season according to FGDs. There is, therefore, a need for further farmer sensitization to affirm and deepen their grasp of the climate change problem in the agricultural sector across the study area. There was also a lack of clear policy guidelines on climate change adaptation measures in agriculture. This implies that there is a need for enhanced efforts towards the creation of awareness of the causes and risks associated with climate change among the policy makers at the Governorate level.

Figure 3: *Climate change attributes that have been experienced as changing over a period of 5 years in NES*



The Need for adoption of Climate Smart Agriculture practices in NES

In 2010, FAO introduced the concept of Climate-Smart Agriculture, often abbreviated to CSA, at The Hague Conference on Agriculture, Food Security and Climate Change. The concept integrates the three dimensions of sustainable development – economy, society, and environment – by jointly addressing food security and climate challenges. It is an approach aimed at developing the technical, policy and investment conditions to achieve sustainable agricultural development for food security under climate change.[5] The approach is based on the action acronym SMART, where S - stands for specific, M - for measurable, A - for achievable, R - for reliable and T - for timely.[6] In the light of the CSA approach, agriculture is therefore considered SMART if it aims at enhancing productivity and returns, improving adaptation of livelihoods and ecosystems and reducing greenhouse gas emissions. The approach includes well proven technologies that already exist and other innovative practices such as conservation agriculture; agroforestry; water harvesting techniques and efficient use of water; use of cultivars/varieties and breeds that can perform better under various climatic stresses; use of safety nets, climate risk insurance and timely climate information access by farmers.

Cognizant of the negative impacts of climate change on wheat production in NES, farmers, local authorities and humanitarian partners need to promote the integration of climate-smart practices into the farming systems and improving agricultural productivity. Agricultural projects must promote a variety of Climate-Smart Agriculture (CSA) practices including rehabilitation of irrigation infrastructure, water harvesting techniques, use of renewable solar energy, conservation agriculture, composting and manure management, use of drought tolerant varieties, integrated pest and disease management, agroforestry and improved Agro-Silvo-pastoralism.

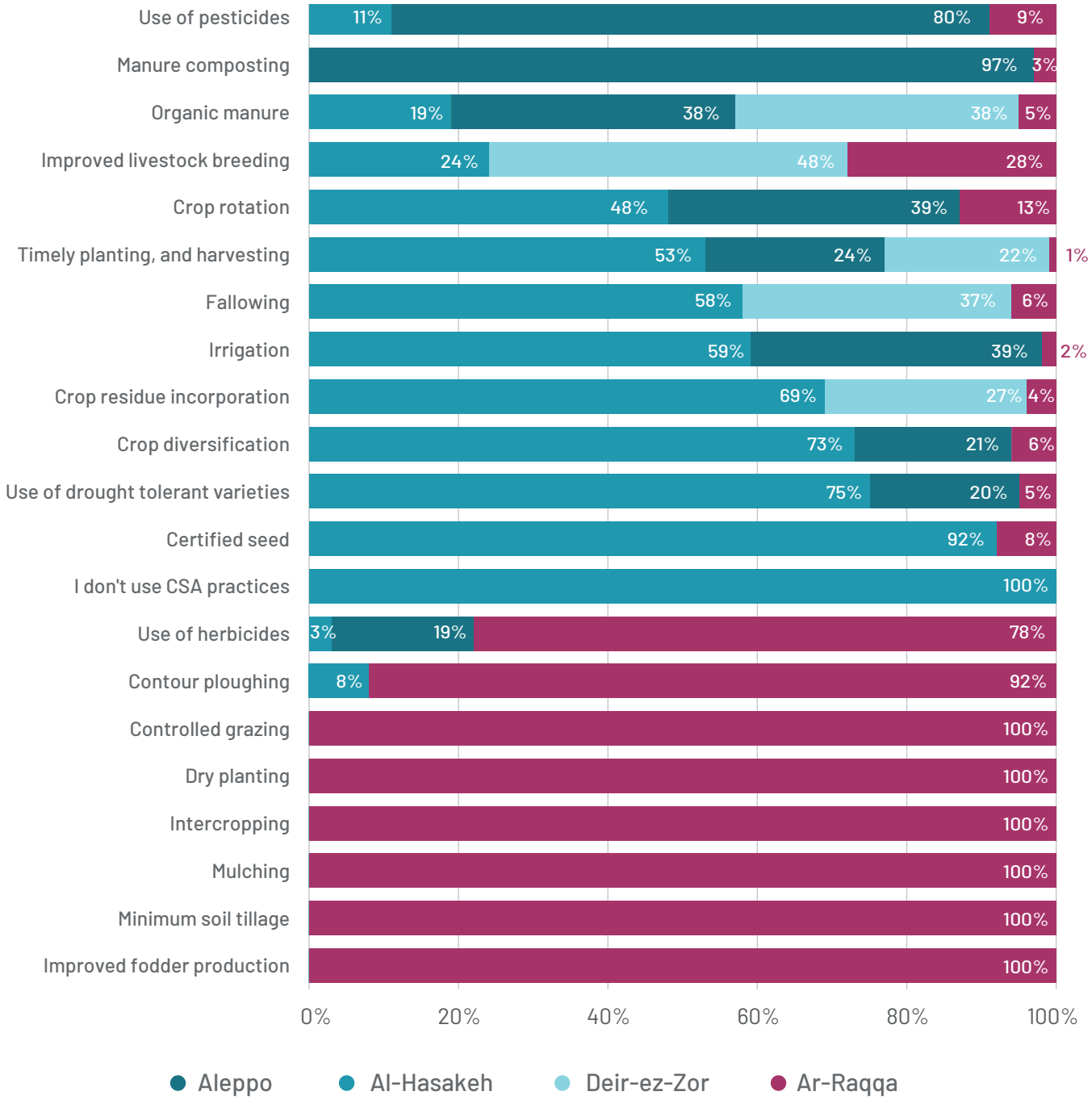
Adoption of Climate Smart Agriculture practices across NES

Most study respondents acknowledged weak efforts towards adaptation efforts to the local effects of climate change across NES. This revealed a considerable emphasis on farmers' poor adaptation strategies to climate change effects among the farming communities in NES. However, Key informant interviews could only indicate adaptation to climate change through the adoption of appropriate timely planting and harvesting of wheat crop (Aleppo governorate – 46%, Al-Hasakeh governorate – 50% and Deir-er-Zor governorate – 73%), use of drought tolerant varieties of wheat seeds (Aleppo governorate – 50%, Al-Hasakeh governorate – 26%), contour ploughing (Ar-Raqqa governorate – 78%), irrigated wheat production (Aleppo governorate – 34%, Al-Hasakeh governorate – 29%) and use of herbicides (Ar-Raqqa governorate – 42%) (Figure 4). Study respondents demonstrated limited understanding of many other adaptation options like minimum soil tillage and dry planting, intercropping, mulching, diversification to other non-farming activities, limited access to accurate weather and climate forecasting information, lack of access to market price information, limited knowledge on soil and water conservation techniques, lack of knowledge on the importance of timeliness of operations on varying planting date and agroforestry. From the interview with technical officers from the local Agriculture and Economic Unit, also affirmed the need to shift towards climate smart agriculture practices such as rehabilitation of irrigation water systems and water harvesting technologies in response to perceived climate change among farming communities.

5 FAO. 2013. Climate-Smart Agriculture Sourcebook. Module 14: Financing Climate-smart Agriculture. Rome,Food and Agriculture Organisation of the United Nations [available at www.fao.org/docrep/018/i3325e/i3325e

6 McCarthy, N., L. Lipper, and G. Branca. 2012. Climate-smart agriculture: smallholder adoption and implications for climate change adaptation and mitigation. Mitigation of Climate Change in Agriculture Working Paper 3.

Figure 4: *Adoption of Climate Smart Agriculture practices across NES*



Key Agricultural Inputs of Wheat Production in NES

Seeds

Before the onset of the crisis in 2012, the Syrian Government's General Establishment for Grain Production was responsible for producing and marketing improved seeds to farmers. However, in recent years, there has been a real problem in securing sufficient quantity and quality of wheat seed for all Syrian regions, including NES. Key informants reported that SANES is one of the most important actors in securing wheat seeds for farmers through the Agrarian Community Development Company, which has a "seed multiplication" department and is responsible for distributing, disinfecting, and sifting the seeds before selling them to farmers. Key informants explained that the company offers some farmers' incentivizing contracts to produce improved seeds at a purchase price. The Seed Multiplication Department then sterilizes the seeds and packages them at the cost. SANES subsidizes the price of the wheat seed distributed to farmers. However, SANES was reportedly unable to sell the seed to all farmers. In fact, vulnerable farmers with limited purchasing power often purchase their seeds from local market dealers that often collect their money in the post-harvest period. On the other hand, traders buy seeds from farmers, store them for the coming seasons and sell them at a price about 25% higher than the price of SANES, without the latter being able to impose seed quality control, price controls and sanctions on offending traders. Some key informants explained that some traders were smuggling large quantities of wheat seeds into NES. The study findings highlighted that there are likely to be challenges with the quality of some of the seeds available in NES. This reality reflects the damage that the prolonged years of war have caused to the process of quality seed development and distribution in NES. It also points to the lack of technical and material resources available to SANES and its department of Agriculture to address this issue. Although there is a research center in Qamishli to develop new types of seeds and laboratories to improve the quality of existing seeds, it still needs a lot of equipment to reach the desired results of improved seeds.

The above findings suggest that the competitive advantage of wheat seeds should be managed by SANES, while the department of Agriculture should redistribute seeds fairly and effectively to all farmers in the region without exception. This management can be reached through the production and proliferation of improved seeds by SANES that reflect positively on the quantity and quality of wheat production. Technical and financial support from international donors, humanitarian partners and international agricultural research centers are necessary for seed development and seed multiplication in NES. The production of improved and qualitative seeds, not just the process of reproducing them, will inevitably lead to demand by farmers and traders for them. Ideally, a quantity of the improved seed should be offered at subsidized prices to meet the needs of all farmers in NES. However, limited financial capacity and the inability to sustain seed material support leads to the need to open channels of communication with traders to sell part of the improved seed at cost and to agree to sell the farmers at an acceptable and defined profit margin.

Fertilizers

Fertilizers are essential natural or chemical substances spread on the cultivable lands to improve crop growth and productiveness. Amid the Russian and Ukraine conflict, fertilizers prices have dramatically increased in the last 6 months. In fact, fertilizers prices have more than triplicated on the international market leaving many of the most vulnerable farming communities worldwide with affordability and availability challenges. Before the Syrina crisis, fertilizers were well-available to farmers in all areas of Syria by the General Establishment for Fertilizer in Homs even when prices were liberalized in 2008. However, domestic production of fertilizer declined by about 90% during the first years of the crisis; today local fertilizers production is gradually increasing since 2018. This decline has led to a lack of sufficient fertilizer and a surge in prices. This has led a large proportion of farmers not to use or use fertilizers in small proportions, which has affected the quantity and quality of wheat production. Key informants reported that SANES work to secure fertilizer for wheat farmers in the region at a price about 20% lower than the market. However, the amounts raised by SANES and displayed only on licensed agricultural land cover less than half of the farmers' need for such materials, which makes most of them rely on the market and traders to secure what is left of their fertilizer needs. High fertilizer prices due to dependence on the outside and weak market control are among the main reasons for the increase in agricultural costs in NES.

This analysis highlighted that traders currently have a competitive advantage in providing fertilizer to wheat farmers in NES, as SANES also depends on traders to secure fertilizer from abroad and sell it at a subsidized price. This reflects negatively on the cost of wheat production as traders usually exploit the situation and put a high profit margin on the composting trade. The cost of importing in hard currency can also impose a significant burden on the region's economy, especially as the value of the Syrian pound continues to deteriorate. To shift the competitive advantage to farmers, international donors, local authorities and humanitarian partners could cooperate with the private sector of registered traders to import the required fertilizers with an acceptable profit margin, accompanied by tightened price and quality control in the domestic market. In the long term, support and resources should be allocated to local fertilizer production, thereby limiting the impact of increased prices of imported fertilizers on the cost of wheat production.

Pesticides, herbicides and other agricultural medicines

Prior to the crisis, a major part of pest and insect control operations affecting wheat crops was carried out directly and with the full support of the Ministry of Agriculture, there was coordination between the Ministry's Scientific Committee for Agricultural Research and the International Center for Agricultural Studies in Dry Areas (ICARDA). Several research projects and studies were carried out on optimal methods to combat wheat pests such as the Sunn pest. Agricultural directorates throughout Syria usually formed committees of technicians from the Protection Department of the Ministry's Directorate for Plant Protection to monitor the spread of agricultural pests and inform the directorates if the ministry needed to intervene with pesticides and agricultural medicines. It is worth noting that the intervention of the Ministry of Agriculture at the time was just to avert the threat of widespread pests only and did not support agricultural medicines. Most of these were purchased by farmers from the private sector. SANES is currently trying to secure pesticides to fight the dangerous pests like the Sunn pest and provide them free of charge to some farmers, but it does not have enough financial means to secure pesticides and medicines for all agricultural pests, which forces the farmer to resort to the special agricultural pharmacies. The study findings also highlighted the weakness of geo-political cooperation at the level of NES and its neighbours regarding pest control. For example, during the previous seasons, Turkey sprayed repellent pesticides to the Sunn pest, pushing it to the Al Hasakeh governorate.[7] This increased the burden of combatting this insect pest on SANES and its vulnerable farmers in NES.

7 https://impactres.org/reports/PolicyPapers/Wheat_production_value_chain_in_NES.pdf

Pricing of pesticides, herbicides and agricultural medicines is done adequately by wholesalers and owners of agricultural pharmacies, with no price control by SANES. Prices of pesticides, herbicides and agricultural medicines are linked to several factors, including prices in the country of origin and import costs, profit margins for wholesalers and retail merchants, exchange rate fluctuations as well as the quantities placed on the market. Traders are considered one of the most important players in the market for pesticides and agricultural medicines in NES. They have a competitive advantage in this commodity because they can control prices and impose the appropriate profit margins, especially from the big traders who are in contact with the suppliers.

The availability and prices of agrochemical products place additional strain on farmers' ability to meet the required inputs for successful wheat grain cultivation and harvest.

In general, prices of Pesticides and herbicides have increased compared to 2021 winter season in NES, for 2022 winter season, prices vary from less than a dollar to 15 $ for the agrochemical inputs. Fungicide – Copper oxychloride had the highest recorded median price of 15.5 USD/kg in Deir-ez-Zor governorate. On the other hand, urea fertilizer - 46% had the lowest reported median price of 0.7 USD /kg across all governorates in NES. 96% of Pesticides, herbicides are available in four governorates in NES, 75% of the agrochemical inputs (fertilizers, pesticides, and herbicides) are imported from China (30%), followed by Syria (25%), then Turkey (14%), from inside Syria, (43%) of the agrochemical inputs are sourced from Damascus, Homs, followed by rural Damascus.

Thus, SANES or humanitarian partners can collaborate directly with the traders in importing the required quantities and types of agricultural chemicals and channel them to the local market while giving an acceptable profit margin to the traders, which will reduce the randomness of the market and pressure the rest of the traders to lower their prices. This will be beneficial to the vulnerable farmers in NES.

Fuel and Water

Fuel has played a key role in increasing the cost of wheat production since 2008, when the Syrian government began a gradual liberalization of fuel and fertilizer prices. But the crisis has led to unprecedented spikes in fuel prices due to significant shortages, which have directly affected the agricultural sector through a significant rise in production costs. With the prevailing crisis, irrigation systems were destroyed, and many farmers were unable to irrigate their land. This was especially true considering the fuel shortage, the absence of spare parts and maintenance services for water pumps, and the theft and sabotage of these pumps.[8] By the time of reporting in NES, restricted supply of fuel has become widespread throughout the region; multiple economic sectors, consumers, and SANES continue to grapple with the ramifications. Wheat production has been impacted by the delay in subsidized agricultural diesel deliveries, putting farmers' livelihoods at risk. Diesel delivery delays forced farmers to purchase black-market diesel at significantly higher prices to irrigate their lands. With the onset of winter, fuel shortages and high prices had a profound impact on agricultural livelihoods, access to basic commodities, and socioeconomic stability in local communities across NES.

8 Food and Agriculture Organization (2019): "FOA and DFID Collaboration to Recover the Seed Multiplication System in the Syrian Arab Republic." Available at: http://www.fao.org/emergencies/fao-in action/stories/stories-detail/en/c/1201280/

Key informants pointed to increased production costs because of the purchase of fuel from the market due to the inadequacy of local authorities' provisions at the subsidized price. The quantity of fuel required is linked to the lack of rainfall to operate the well pumps. Most of the wheat lands in NES depend on well water and rainfall to irrigate their crops. Therefore, the abundance of water is linked to the abundance of the rainy season; the cost of getting water from wells is related to the price and availability of fuel. SANES plays a key role in providing fuel and water to farmers by subsidizing the price of fuel and rehabilitating irrigation systems. However, the limited resources do not allow this support to include all farmers and cover all their needs sustainably. This resulted in SANES losing its competitive advantage in terms of fuel and water security, thus pushing farmers to rely more on the market and buy at high prices. To this end, consideration could be given to adjusting the price of subsidized fuel to farmers to achieve a sustainable price that could be higher than the current subsidized price and lower than the market price, with the quantities at the new subsidized price covering the entire fuel needs of farmers. This process may contribute to a decrease in the price of fuel in the market as a result of low demand from farmers if they obtain their full needs from SANES. Another alternative could be support for the installation of water pumps running on renewable energy (solar or wind); such an alternative has a high initial cost yet offers higher profitability and sustainability on a longer-term basis. Local authorities and humanitarian partners should work on incentive plan to promote and facilitate the usage of an alternative source of energy due to challenges related to fuel mentioned.

SANES should play a greater role in ensuring the continuation of water pump work among farmers, as it can reactivate pump repair tablets. In the absence of financial liquidity, SANES can conclude cooperation agreements with the private sector to repair pumps and set aside the amounts owed to farmers under the guarantee of SANES. In parallel, cooperation with international donors, humanitarian partners, local authorities and farmers must continue to repair and develop modern irrigation systems, surface water collection and storage systems to service the lands of the region and alleviate the uncertainty surrounding the rainy season.

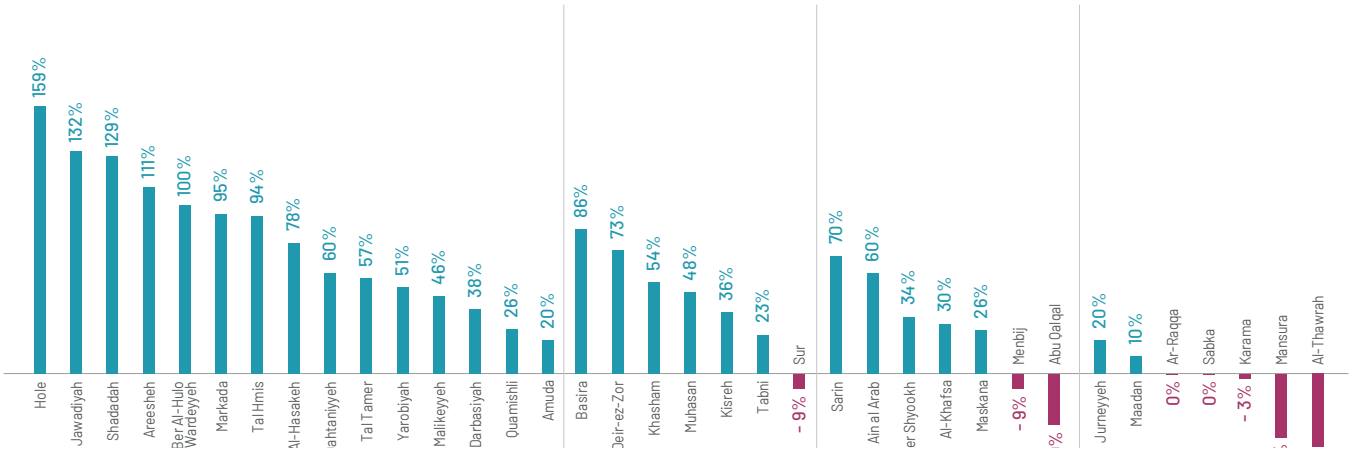
Harvest and Post-Harvest Handling of Wheat Grain in NES

Harvested wheat grain in NES

From the first FGD session with the SANES Agriculture and Irrigation Authority, it was indicated that 2021/2022 Irrigated crops harvest season was overall better than the previous year. The percentage of wheat grain received by SANES from farmers also increased 41% compared to the previous season. In fact, (388) metric tons of wheat were produced for milling purposes as well as (75) metric tons of raw seeds according to SANES official website. This wheat production improvement can be due to SANES facilitation procedures such as provision of subsidized seeds and fuel and the purchase of harvest at higher prices even more than global wheat price. Yet most importantly, the improvement of wheat productivity could be attributed to the relative increase of annual rainfall amount in 2021/2022.

The recorded improvement of annual rainfall for the year 2012/2022 compared to the previous year was also concurred by study findings on NDVI vegetation cover under irrigated lands in NES. Most of the subdistricts in NES recorded improvement in irrigated land area in 2021/2022 as compared to 2021/2021 (Figure 5). Al Hasakeh governorate recorded 79% huge improvement of irrigated land area, Deir Ez Zor governorate recorded 59% improvement, Aleppo governorate recorded improvement of 25%.

Figure 5: *Percentage difference between 2021-2022 total irrigated land area in hectares in April peak season*



Most of the governorates recorded an improvement of total irrigated land areas in April 2022 peak season, while in Ar-Raqqa governorate in decreased by 5% compared to last year (Figure 6). While comparing the 2022 peak season to 2018 drought season, Al Hasakeh governorate in 2022 recorded an improvement of 9% of irrigated land compared to 2018. In Al Hasakeh governorate, the largest Irrigated land area as per the NDVI analysis is Al-Malikeyyeh Sub district with 44% of its agriculture land is irrigated. In Ar-Raqqa governorate 9% of its agriculture land is irrigated, Khasham subdistrict in Deir Ez Zor governorate recorded the largest irrigated land, and Lower Shyookh is the largest irrigated area in Aleppo governorate as per NDVI data in April peak season.

Figure 6: *Total irrigated land area per governorate in NES in March/April in Hectare*

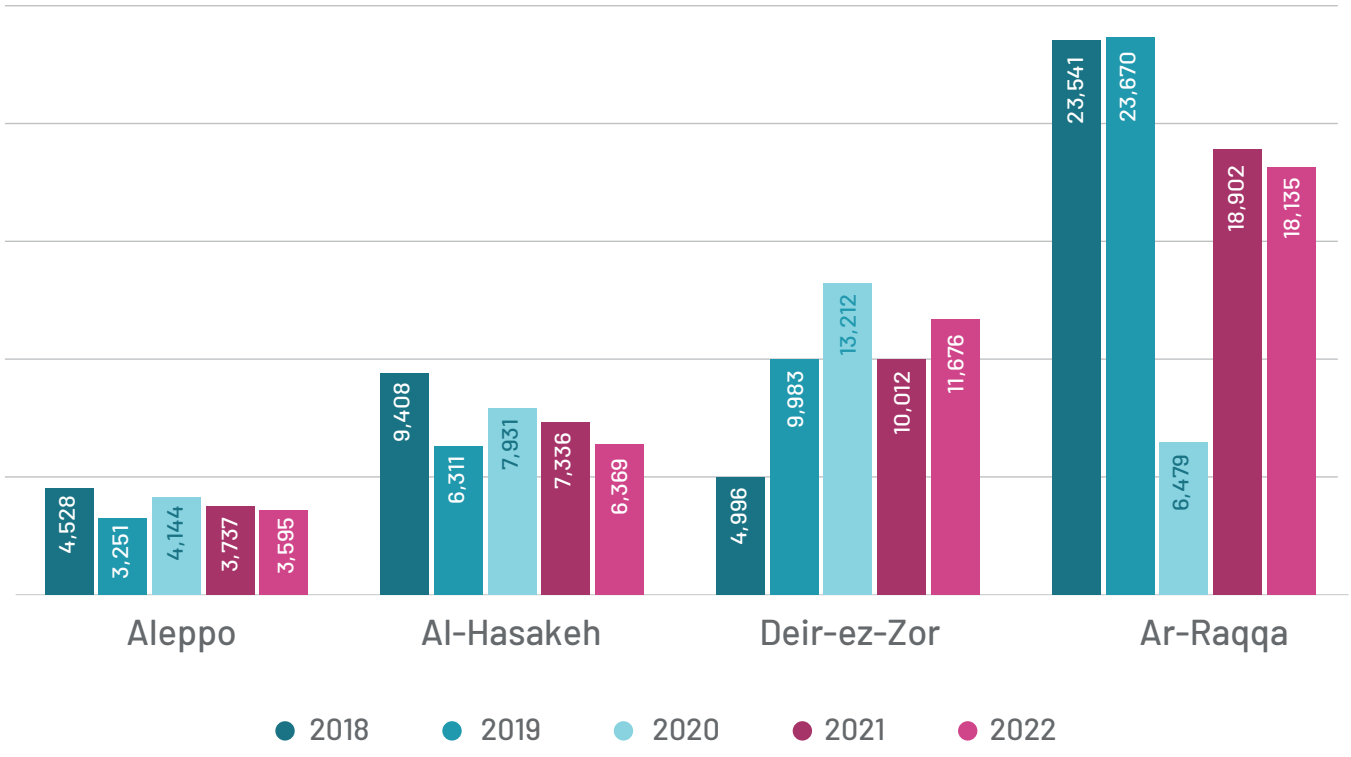
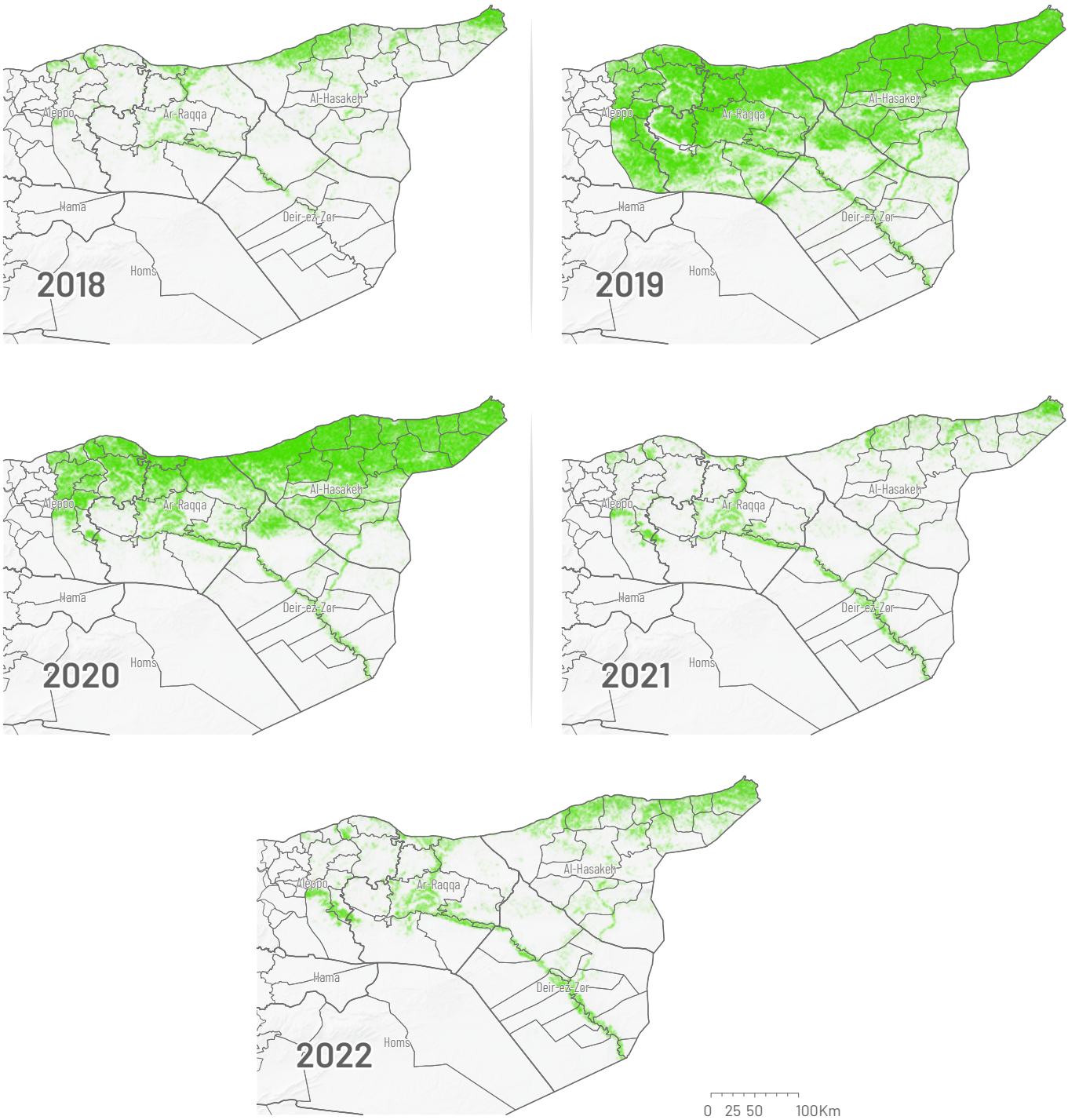


Figure 7: *Comparative NDVI Maps represent the total area in April from 2018-2022*



Wheat production status by agro-ecological zones in NES

Wheat crop yield was reported to range from 1 – 2 tons per hectare under rain-fed agriculture and 2 – 3.5 tons per hectare under irrigated agriculture. In the agrological zone 1; key informant reported that wheat productivity was better than last year. In agroecological zones 2 and 3 wheat production from irrigated land was reportedly poor and well below average, due to the lack of rainfall, the lack of surface water, the difficulty of providing fuel, and the spread of weeds among the crop and medicine prices were high. While rainfed wheat crop production completely failed. In agroecological zone 5, wheat production reportedly improved by 20-50%, and in agroecological zone 4 it improved by 15% due to the improvement of seed quality and rainfalls amount received as compared to the previous cropping season. For agroecological zones 4 and 5, wheat production was moderate to good compared to last year.

Coping mechanisms adopted by farmers in wheat production

In agroecological zone 1 and 2, rain-fed wheat-producing farmers had to rent their land to other farmers, reduce the cultivated area per household, and sell the failed wheat crop stand as forage or fodder to livestock keepers. Some farmers sold failed wheat crop stands as livestock forage at 250 SYP per dunum. In agroecological zone 2 and 3, some farmers shifted from wheat cultivation because of the high costs of production and resorted to the cultivation of high-value crops with lower-cost production e.g., sesame and beans. Such farmers reduced the usage of chemical fertilizers and added organic fertilizers as an alternative due to their relatively low cost. In agroecological zones 4 and 5, with high temperatures, farmers resorted to increasing the irrigation schedules and cycles as well as the use of drought-tolerant varieties. There was also ease in the use of renewable solar-powered irrigation systems to replace expensive fuel. There was also the adoption of organic manure, foliar sprays and urea as substitutes for the highly expensive granular ammonium nitrate fertilizers. As mentioned before, across all the agroecological zones, farmers sold portions of the failed wheat crop as forage to livestock feeders.

Selling and marketing of wheat grain at post-harvest

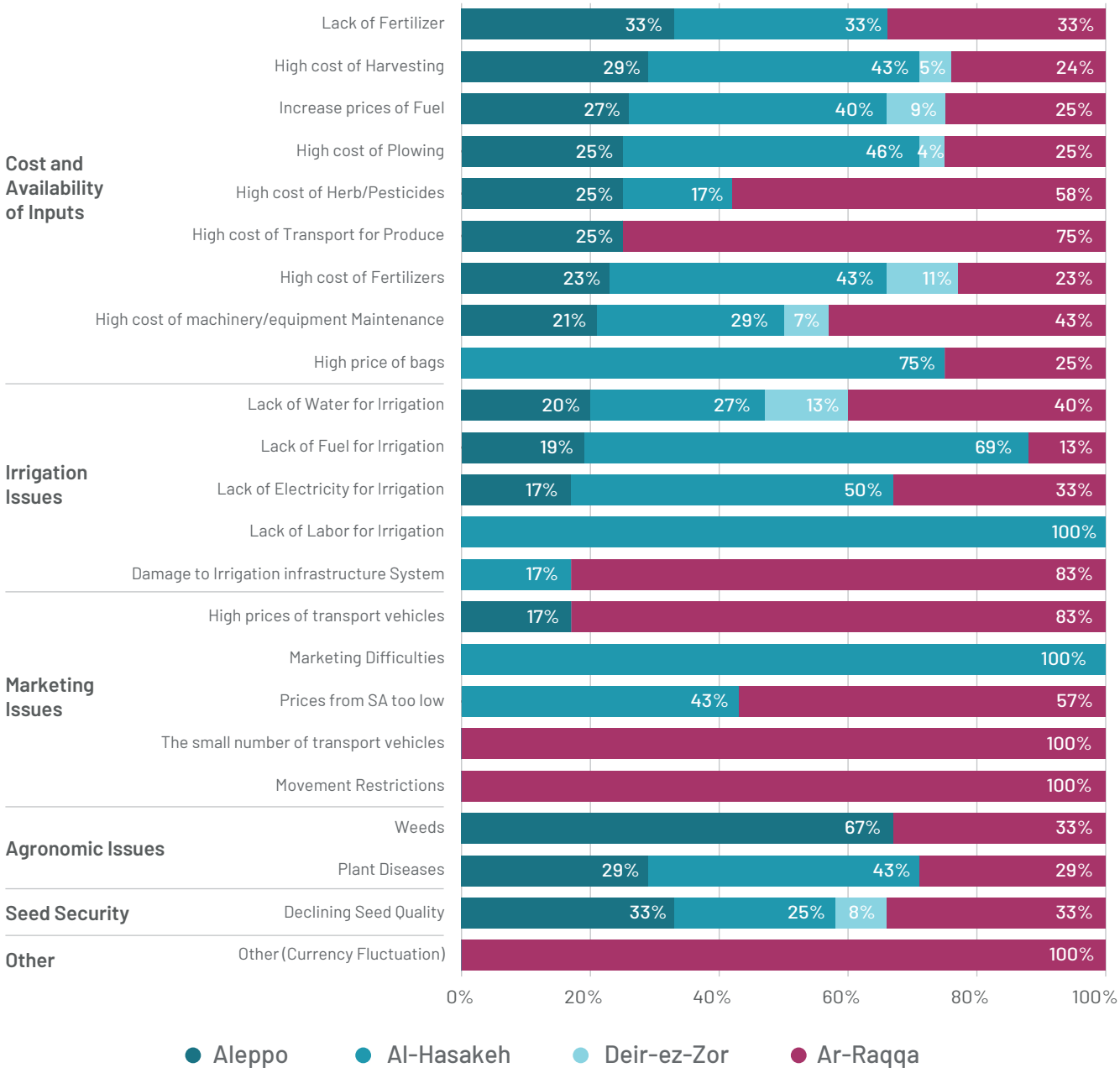
This section includes the activities related to the sale and marketing of wheat by farmers in terms of buyers, including SANES, traders, the Government of Syria (GoS), pricing mechanisms, transport and purchase facilities, and the method of payment recognized in NES. The section also addresses the destination of the wheat crop and the profitability of the farmer during the season. The key informants explained that SANES is the main buyer of the wheat grain in the region and estimated that it accounts for about 80% of the total production. At the beginning of each season, SANES takes several measures to buy wheat, including determining the total budget available, preparing silos and delivery points. In addition, it determines the price of wheat based on prolonged discussions with the agriculture committees and assessments implemented by subcommittees spread throughout NES. SANES considers wheat a necessary immediate need to be distributed to mills and a strategic commodity that is important to be stored for years to come. SANES does not prevent farmers from selling the crop to traders. It determines the purchase price and leaves the farmers to estimate the most appropriate price for it. Part of the wheat goes to the traders who buy the wheat from the farmers, especially the relatively small producers, at a price that is about 10-20% lower than the SANES's price, depending on the type and grade of wheat grain. The traders are the ones who will bear the costs of transport and sale. Most of them have the advantage of paying the farmer' dues directly, so they do not have to wait long to get the value of their wheat grain. Traders sell wheat to private mills, SANES, or GoS after taking advantage of economies of scale that allow them to buy and assemble large quantities of wheat grain from small farmers. Some key informants pointed out that a small percentage of farmers sell directly to the GoS centers located in the area. The farmer bears the costs of transporting wheat grain to the delivery centers of SANES.

Last season, SANES fixed the price of a kilogram of wheat at a range USD 0.17 – 0.20, which was equivalent to Syrian pounds on the exchange rate at that time. One key informant noted that farmers, wishing to avoid the impact of any collapse in the value of the Syrian pound, demanded and agreed to set the purchase price in dollars when the bill was received. SANES can determine trends in the wheat market through its pricing. If it offers a competitive price, it can capture a major share of the wheat grain in the region. But if the price does not align with farmers' expectations, many of them will turn to other market actors to sell their crop. SANES must therefore set a purchase price that provides a fair profit to farmers while giving them a competitive advantage in the wheat market. Based on the key informants, the purchase price set by SANES is one of the main factors determining the profit rate of wheat farmers, which currently ranges, according to their estimates, from 10% to 35%. The administration can motivate farmers to sell their crops to it by implementing steps that have a positive impact on the activities associated with the sale. These could include effectively controlling transport costs and providing more facilities in the transport process, especially for small farmers. Other measures could include enhancing the administrative and resources available and easing procedures so that farmers' dues could be handed over with fewer obstacles.

Main Challenges Faced for 2021/2022 Winter Wheat Cropping Season

The study findings across the wheat production, harvest and post-harvest handling highlighted various challenges that negatively affect the efficiency and sustainability of wheat crop production (Figure 8). Key informants and focus group discussions reported many of these constraints, including high prices of fuel, fertilizer and seed, a lack of agricultural extension service delivery, lack of financial loans for farmers to support the production process, climate induced water scarcity, slow maintenance of irrigation water systems, the need for locally based fertilizer production plants, and a lack of large silos because of war damage. Also mentioned is the emigration of technical experts and agricultural workers, a weak presence and coverage of humanitarian partners supporting wheat production in NES, a lack of monitoring and follow-up on the implementation of decisions in support of farmers, and delays in the payment of farmers' dues after the delivery of the wheat grain.

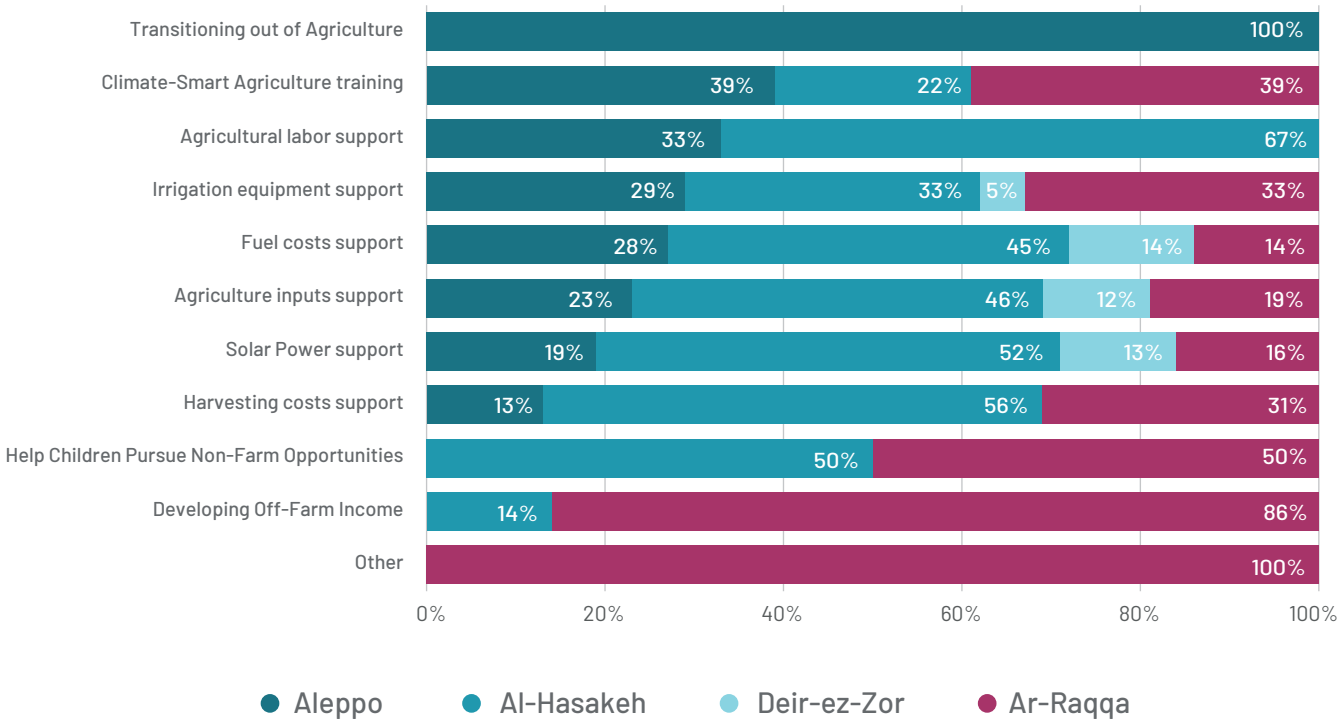
Figure 8: *Main challenges faced for 2021/2022 winter wheat cropping season*



Preferred support to improve wheat crop productivity in NES

Meanwhile, the study also highlighted the preferred for support to improve wheat production in NES as reported by study respondents (Figure 9).

Figure 9: *Preferred support for the 2022/2023 winter wheat cropping season and beyond*



3. Recommendations

Recommendations and implications on agriculture-based livelihood programming in NES

The reliance of a large part of the population on wheat cultivation for income, its contribution to food security, and its strategic importance renders it crucial to overcome bottlenecks in wheat production which have been highlighted by the present study. The policy and practical measures that can be adopted by local authorities, farmers and humanitarian partners can be summarized as follows:[9]

- It is recommended for local authorities, humanitarian partners and farmers to upscale their funding for wheat production projects in the 2022/23 winter cropping season and beyond. Vulnerable farmers basically need immediate support of cash, inputs and training to overcome the continuing hard conditions they are going through," as stated by Mike Robson – FAO Representative in the Syrian Arab Republic.[10]
- Provide comprehensive support by training a group of experts from the SANES's department of Agriculture and related humanitarian partners to provide efficient agricultural extension service delivery and early warning to the farmers regarding weather, pests, diseases, and other adverse conditions.
- The local authorities, community leaders and farmers must develop and reform the tax system on the sale of agricultural land to achieve greater justice for vulnerable farmers working on land owned by others such as "taking possession." For example, an agreement can be obtained between farmers and landowners to impose a specific calculated tax on the share of owners of wheat used to provide technical and financial support to wheat farmers who do not have what can be considered a competitive advantage in means of production such as large agricultural land with high productivity.
- It is recommended to initiate collaboration of local authorities, farmers, humanitarian partners, national and international research centers to improve the production of seeds to cover the needs of farmers. Drought tolerant quality wheat seeds should be provided at subsidized prices, especially benefiting vulnerable smallholder farmers. Furthermore, the local authorities could cooperate with the private sector to sell them a portion of the improved seeds and agree with them to sell to farmers with a low and determined margin of profit, which would control the randomness of the current market and help stabilize the prices.
- It is recommended to work to reduce the burden of the prices of fertilizers, pesticides, herbicides, and other agricultural medicines to ensure they are available and affordable to vulnerable farmers. This can be achieved through cooperation between the local authorities, humanitarian partners in NES and international institutions to provide appropriate information to understand the quantity and quality of wheat production inputs needed to increase wheat crop productivity and determine what is to be imported from abroad, thus better estimating the total cost. Cooperation with the private sector can take place in importing the required but locally missing inputs, which should be accompanied by tightened price controls on the local market. In the long run, resources must be allocated to produce agricultural inputs locally, thereby reducing production costs and dependence on imports.
- The subsidized price of fuel to farmers should be adjusted to reach a sustainable (higher) price that covers the needs of farmers. This also contributes to reducing the price of fuel on the black market because of low demand. In terms of water, the local authorities and humanitarian partners should play a greater role in ensuring the continuity of water pumps work across farming communities. There is need to reactivate pump repair tablets, cooperate with humanitarian partners to upscale rehabilitation of irrigation water networks, and develop and introduce modern precision irrigation systems, which will increase the wheat productivity of the land.

9 https://impactres.org/reports/PolicyPapers/Wheat_production_value_chain_in_NES.pdf

10 https://www.fao.org/syria/news/detail-events/en/c/1602143/

- It is recommended that SANES, humanitarian partners, and relevant counterparts encourage the installation and use of alternative energy sources such as solar panels as a sustainable and efficient solution for farmers in order to alleviate the burden of fuel on farmers in terms of availability, prices, and agriculture necessitates.
- Facilitate cooperation between humanitarian partners and SANES's department of Agriculture to continuously provide technical training courses for agricultural workers and those involved in agricultural work. In addition, agreements should be made with the private sector to secure agricultural equipment and lease it to farmers at an acceptable profit margin, with effective control of labor and agricultural equipment costs to be committed at specific prices.
- Regarding the post-harvest of wheat grain sale and marketing, the local authorities can effectively reduce the cost of transporting wheat to delivery centers and provide more facilities in this area, especially for small farmers. This should take place in addition to easing procedures and removing obstacles that prevent the direct delivery of financial benefits to farmers. The above proposals require a transparent institutional environment and the rule of law, effective monitoring and monitoring tools, and the participation of all market actors in the planning and implementation process, including the private sector, farmers, and agricultural associations. The appropriate institutional environment encourages humanitarian partners and donors to provide the necessary technical and financial support.
- International research centers are also encouraged to provide the necessary assistance to increase the productivity of wheat lands and thus their yield to all actors, especially farmers. Secondary data and information from key persons indicate that the average production of a watery hectare in the studied area ranged from 2 to 3 tons of wheat. In several wheat-producing countries, the average is about 4.5 tons.[11] Increase production by 50% to align with the international average can increase profits, support the strategic wheat stock in the region, with the surplus wheat exported in cooperation with the local private sector.

11 Purdy, R. and M. Langemeier (2018): "International Benchmarks for Life Production", farmdoc daily (8):124, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign. Available at: https://farmdocdaily.illinois.edu/2018/07/internationalbenchmarks-for-wheat-production.html