agronomy

Editorial

Herbaceous Field Crops' Cultivation

Sara Lombardo * and Giovanni Mauromicale

Dipartimento di Agricoltura, Alimentazione e Ambiente (Di3A), University of Catania, via Valdisavoia 5, 95123 Catania, Italy; g.mauromicale@unict.it
* Correspondence: saralomb@unict.it; Tel.: +39-095-4783421

Citation: Lombardo, S.; Mauromicale, G. Herbaceous Field Crops' Cultivation. *Agronomy* **2021**, *11*, 742. https://doi.org/10.3390/agronomy11040742

Received: 10 March 2021
Accepted: 7 April 2021
Published: 11 April 2021

Herbaceous field crops include several hundred plant species spread worldwide for different end-uses, from food to non-food applications. Among them are cereals, grain legumes, sugar beet, potato, cotton, tobacco, sunflower, safflower, rape, flax, soybean, alfalfa, clover *spp.* and other fodder crops. Only 15–20 species play a relevant role in the global economy, representing about 1600 Mha of harvested area in total. Herbaceous field crops can be grouped according to different standpoints, as follows:

- Taxonomy (division, subdivision, family, etc.);
- Life cycle (annual, biennial or perennial crops);
- Climate (tropical, sub-tropical or temperate crops);
- Growing season (spring-summer-autumn, autumn-winter-spring, indifferent);
- Primary end-use (cereals or grain crops, grain legumes, sugar crops, oil crops, fiber crops, rubber crops, fodder crops, aromatic crops, bioenergy crops);
- Used plant part (reproductive organs, subterranean organs, foliage, grass or foraged materials).

In recent decades, the rapid increase in global population and the parallel decrease in arable land has necessitated efforts to develop sustainable agricultural systems for the cultivation of herbaceous field crops. In light of this, the present special issue entitled "Herbaceous Field Crops' Cultivation" publishes articles from colleagues worldwide and provides detailed research involving several aspects of herbaceous field crops' cultivation. It contains two reviews and 22 original research papers devoted to elucidating the impacts of management factors (i.e., genetic background, planting density and arrangement, fertilization management, irrigation, weed control and harvest time) on the yield and qualitative performances of 11 field crops (wheat, cardoon, potato, clary sage, basil, sugarcane, canola, cotton, tomato, lettuce and hemp).

The current challenge of agriculture is to reconsider our production systems in search of the best agronomic practices that are able to reduce yield losses by enhancing the resilience and sustainability of crops. In this spirit, natural genetic variability within crop species gives plant breeders the opportunity to develop new and improved genotypes with desirable characteristics (yield potential, pest and disease resistance, etc.). As a result, nowadays, there is a need to take into account new breeding methods, given that several factors limited conventional breeding, based on phenotypic selection, for some crops. To this end, Yadav et al. [1] provide an overview of genomic selection, based on DNA marker profiles, in sugarcane breeding programs. Indeed, molecular markers are advantageous when compared to conventional phenotype-based alternatives since they are stable and detectable in all tissues regardless of the growth, differentiation, development or defense status of the cell. The potential to reduce the breeding cycle length, to increase the prediction accuracy for clonal performance and to increase the accuracy of breeding values for parent selection is also greatly documented by Yadav et al. [1], especially in comparison with other crops. However, in our opinion, a breeding strategy based on molecular markers may be implemented for any crop only through an integrated and collaborative approach with agronomists, engineers and farmers. Indeed, this allows us to select new and improved cultivars within crop species with desirable traits (yield potential, pest resistance, etc.), which must be confirmed in either multi-year or multi-site experimental field trials. From this perspective, most of the research articles included in the present special issue elucidate interactions between genotype and climatic conditions (due to different growing seasons or locations), as well as between genotype and other agronomic factors, such as planting density and fertilization rate. The exception is the study conducted in South Italy by Tuttolomondo et al. [2], which only focuses on the genotype's effect. In particular, the obtained results demonstrate as the biometric and production traits could be used for differentiating clary sage accessions with the aim of achieving a wider expansion of this medicinal and aromatic species. Indeed, an increase in crop genetic diversity, in general, may allow more flexibility for agricultural production. Taking that thought, as an instance, the 'Messina' accessions are of particular note for obtaining a higher essential oil yield performance per hectare.

The objective of increasing the productivity of herbaceous field crops may be rationally reached by modulating planting density and arrangement since the latter may affect plant architecture and growth, resource utilization, disease and pest tolerance, as well as carbohydrate production and partitioning. The proper planning density for any crop can vary considerably depending on many agronomic factors such as sowing time, fertilization, soil moisture and pest management for different geographic locations. Accordingly, Khan et al. [3] find that the adoption of a planting density of 8.7 plants m^{-2} enhances cotton yield and fiber quality, as compared to the conventional wider rows and lower plants ha^{-1} adopted in the studied area. Through further field trials, Khan et al. [4] examine over two growing seasons the effects of three planting densities (low, 3×10^4; medium, 6×10^4; high, 9×10^4 plant ha^{-1}) on lint yield, leaf structure, chlorophyll fluorescence and leaf gas exchange attributes in two cotton cultivars ('Zhongmian-16′ and 'J-4B'). The results evidence that medium and low planting densities are able to improve the leaf structural and functional traits of cotton cultivars grown in subtropical regions. Once again, however, the crucial role of varietal choice is confirmed, as highlighted by the different canopy architectures and yield formations of the selected cultivars in relation to the planting densities. Conversely, Zaheer et al. [5] find that planting density (20 vs. 40 plants m^{-2}) does not have a significant effect on the grain yield of canola. Indeed, the effect of planting density on yield can vary with geographic location and cultivar. In addition to the possible effects on plant physiology and crop yield, planting density and arrangement can also influence crop quality. In this framework, according to Deng et al. [6], it is not appropriate to increase the planting density to over 32–37 plants m^{-2} in hemp production, if you are to ensure a high fiber yield per area. Indeed, as reported by the researchers, when the planting density reaches a certain level, hemp fiber yield decreases due to a self-thinning effect.

In a scenario characterized by declining natural resources, climatic changes, demographic increases in urban areas and depopulation in agricultural ones, the improvement of soil fertility is imperative for future food security, and can be achieved by sustainable agricultural production systems. From this perspective, multiple cropping systems offer undoubted agroecosystemic services, including soil preservation. Although there exists well-documented literature on intercropping approaches, a successful multicropping system necessitates specific consideration of the agronomic management practices that are able to overcome some disadvantages experienced in intercropping systems, such as yield reduction of the main crop and higher labor costs over monocultures. As such, the management of planting density and spatial arrangement has a crucial role to play in reducing intra- and inter-specific competition for natural resources and external inputs. Nadeem et al. [7] suggest the adoption of a 120 cm trench planting pattern, along with lentil intercropping for improved LER (land equivalent ratio), economic return and seed yield of sugarcane, as compared to other intercropping patterns and a control (sole cropping), likely due to the improved utilization of farming inputs and an increased lentil plant population. This positively influences variability in millable canes m^{-2} due to increased nutrient accessibility, better air circulation and interception of light, resulting in reduced shoot mortality and better growth of canes. In line with these principles, sugarcane planted via 120 cm trench planting also presents greater LAI (leaf area index) and plant height, as well as higher values of total sugar yield.

The maximum yield potential of herbaceous field crops can be successfully achieved with a balanced mineral nutrients supply. Among the primary nutrients required by plants, nitrogen (N) is one of the most limiting factors for plant growth and crop yield formation. Nevertheless, the current awareness of the environmental impacts of agricultural practices has enforced additional efforts to reduce the N losses from crop production systems. A study conducted in Southern Italy [8] on potato indicates that the adoption of cultivars characterized by high nitrogen use efficiency (NUE) at a low N fertilization rate and a soil nitrate test prior to planting are effective tools for achieving more sustainable and cost-effective N fertilization management. As reported by the researchers, however, N fertilization should be commensurate to climatic conditions. Indeed, only a small rate of N fertilizer applied in surplus to potato carries over to the succeeding crops, while most of this is probably lost over summer by volatilization (N_2O and NH_3) and in autumn, when rainfall exceeds evapotranspiration, by leaching of NO_3^-. Thanks to the research of Lombardo et al. [9] the effect of the N fertilization rate on both the agronomic and qualitative traits of potato is elucidated. Particularly, a higher nutritional profile of the tuber (i.e., high levels of dry matter, starch, total polyphenols and ascorbic acid, and low nitrate amount) is obtained by supplying 140 kg N ha^{-1}, as compared to the conventionally adopted 280 kg N ha^{-1}. This is relevant to reducing the N fertilization rate while enhancing the yield and quality of the product. However, it is important to underline that the proper N fertilization rate required to maximize potato yield may vary on the basis of soil traits, cultivar choice and the type of N fertilizer. The potential to reduce environmental N losses by increasing the NUE of crops is also explored by Conversa and Elia [10] on lettuce, the most important leafy vegetable worldwide. On the basis of the critical N curve, i.e., plotting at each time interval the minimum N concentration corresponding to the maximum aboveground dry weight, the authors suggest the use of a butterhead typology as compared to crisphead ones. As the authors speculate, the differences in growth between fertilized butterhead and crisphead typologies may strictly depend upon their light interception capacities, which in turn, are due to their specific head shapes. In particular, the greater root apparatus of the butterhead type, resulting in a larger uptake of soil-N, may explain its higher shoot dry weight accumulation. In addition, the values of NUE underline the poor ability of the crisphead type to absorb soil N and utilize the absorbed N to produce a foliar dry biomass concentration, in comparison to the butterhead typology. Considering the relevant roles of other agronomic factors on crop NUE, Zaheer et al. [5] explore the relationships among planting density, time of N fertilizer application and N fertilization rates, with the aim of enhancing canola yield and quality. Briefly, the researchers conclude that the application of N fertilizers in two splits at 120 kg N ha^{-1} combined with 20 plants m^{-2} could be a valuable strategy to achieve good qualitative attributes (especially in terms of glucosinolates and protein levels) and yields of canola. An optimal N supply at a proper time is a feasible strategy for mitigating N losses from any crop, as the split application of N fertilizers ensures the availability of this nutrient when it is required by plants. In addition, high N fertilization rates as a basal dose can be toxic to seeds and potentially expose the emerging crop to losses. A split N fertilization supply can be, therefore, beneficial from agronomic, economic and environmental standpoints.

In this scenario, the use of legumes within multicropping systems represents an excellent alternative to conventional N fertilization by providing multiple services in line with sustainability principles. Accordingly, Toukabri et al. [11] prove that the mixture of fenugreek and clover, as companion plants to durum wheat, may preserve soil moisture and, hence, help to mitigate the plant's water stress. Intercropping with legumes is a valuable option, especially under water-limiting field conditions, since these crops provide an extra canopy, which is able to minimize soil water evaporation losses. However, several criteria (e.g., pedoclimatic conditions, biological cycles of the main crop and companion ones, biomass and nutrients produced by the legume crop, etc.) must be considered as part of the choice of a single legume crop or a mix of species.

Phosphorus (P), along with N, plays a pivotal role in the reproductive growth and yield formation of herbaceous field crops. However, an excessive P fertilization rate increases the risk of P losses to surface and ground waters, impairing aquatic ecosystems through eutrophication. Although soil P reserves vary across the world, the estimated increase of the costs of high-quality P fertilizers and of the global demand for these supports the need to manage P fertilization on the basis of a suitable soil test and a prediction of crop requirement. In research conducted by Iqbal et al. [12] in Jiangsu (China), increasing the P rate up to 200 kg ha^{-1} improves the yield and reproductive organ biomass, as well as macronutrients' (N, P and K) accumulation, in cotton cultivars, especially those with low P-sensitivity. In other words, managing P fertilization according to cultivar P-sensitivity is essential to effectively boost cotton yield. In addition, Iqbal et al. [12] find that, because of the indeterminate growth of cotton, the nutrients' deposition varies with the advancement of growth stages. This knowledge may be useful for growers making management decisions to maximize seed cotton yield. In particular, it is unquestionable that a better equilibrium among vegetative and reproductive growth, achieved by supplying a proper P fertilization rate, is essential to establishing a good and balanced source–sink relationship for any crop species.

The importance of potassium (K) for the physiological processes vital to plant nutrient and water uptake, nutrient transport, plant growth, dry matter production and transportation is largely documented, especially under adverse conditions. Although K fertilization is the primary source of this macronutrient in agricultural production systems, the application rate of K fertilizer is often insufficient to overcome the severe soil K deficiencies that regularly occur in some geographic areas. Therefore, an evaluation of the optimum K fertilizer recommendations at a local scale is needed for several crops. Accordingly, Ma et al. [13] suggest that a K fertilizer dose of 210 kg ha^{-1} is able to enhance cotton biomass, fiber quality and economic profit in the Yangtze River Valley (China) and similar climatic regions. In particular, the researchers highlight, for both P and K fertilization, how a proper rate may positively influence the yield and qualitative traits of cotton, provided that specific attention is given to climatic conditions and genotype. In this context, while a major research effort has been devoted to demonstrating the yield and qualitative benefits to herbaceous field crops of the fertilizer application of individual macronutrients, there is little understanding to date about the impact of NPK fertilizers' application. Due to the low utilization efficiency of fertilizers, especially NPK ones, over 50% of the nutrients supplied are wasted and can contaminate soil and water resources. Thus, it is crucial to establish how to effectively utilize fertilizers or to increase the nutrient use efficiency of crops to obtain high yields in a sustainable way. Comprehensive research conducted by Deng et al. [7] elucidates the potential to improve hemp fiber yield by combining a proper NPK application rate with an adequate choice of planting density. Since increasing the P or N fertilization rate generates a positive effect on hemp yield, while increasing the K fertilization rate or planting density has a negative impact, the authors conclude that to obtain yields of hemp with high-quality fiber of greater than 2200 kg ha^{-1}, the optimal ranges for cultivation conditions are: 329,950–371,500 plants ha^{-1}, 251–273 kg N ha^{-1}, 85–95 kg P_2O_5 ha^{-1}, and 212–238 K_2O kg ha^{-1}. These indications are useful for reducing the environmental impacts of hemp production that result from the large amounts of fertilizers required during the growing period to achieve high biomasses and rapid plant development.

Fertilization management under organic farming deserves specific attention due to the limited range of fertilizers and plant protection products allowed. As a result of this, the search for alternative nutrient sources is constantly evolving under organic farming. Recently, biochar, produced through the pyrolysis of lignocellulosic biomasses, has been attracting interest for its ability to improve the water-holding capacity and organic matter content of soil. This is relevant in marginal lands, particularly those that are scarcely rainfed and where irrigation is difficult for several reasons. In a study conducted in northern Italy, Ronga et al. [14] suggest the use of digestate and biochar fertilizers for processing tomato, a globally important cash crop. Indeed, both liquid digestate and biochar ensure greater yields, allow a higher plant growth (expressed in terms of a higher fruit number per plant, fruit weight, main stem length and aboveground biomass), and also improve the °Brix and Bostwick viscosity, two important fruit quality parameters when processing the tomato crop. In particular, the highest values for fruit number per plant and fruit weight found when using liquid digestate and biochar fertilizers may be conducive to an increase in water (rainfall and irrigation) and nutrient retention (carried by liquid digestate) in the soil due to biochar supply. In addition, as reported by the authors, digestates present phytohormones and other bioactive compounds that are able to improve plant growth.

Recently the use of silicon(Si)-based fertilizers has been increasingly reconsidered by researchers on account of the numerous benefits of this element to plants. A main function of Si is to enhance plant growth and yield, especially under conditions of stress, by increasing resistance to diseases and pathogens, metal toxicities, salinity and drought stresses. In addition, Si fertilization has the potential to affect the absorption and translocation of several macro- and micronutrients. In this framework, Kowalska et al. [15] propose that Si fertilization is effective for minimizing the negative impact of drought stress on wheat that is organically grown. In addition, a tendency is noted for protein accumulation in the grain of the cv. Rusałka to be promoted when fertilized with Si, as a seed dressing and foliar spray. In our opinion, however, as the positive effects provided by Si fertilization are strictly related to its accumulation in plant tissue, further studies elucidating the possible mechanisms of Si uptake and transport in plants are needed.

The soil inoculum of arbuscular mycorrhizal fungi (AMF) may also play a key role in plant nutrition under organic farming, since plants may benefit from mycorrhizal symbiosis through a better uptake of mineralized soil nutrients present at low concentrations. Indeed, Lombardo et al. [16] find that the application of AMF improves the marketable yield of organic potato, especially when grown in low fertility soils such as calcareous ones. In addition, it is demonstrated that AMF application may enhance the marketable yield of potato plants, as well as the efficiency of photosynthesis rate and stomatal conductance, especially when adopting halved fertilizer doses and using locations with unfavorable soil conditions for potato growth. Accordingly, it should be emphasized once again how the use of AMF is in line with the principles of greater sustainability in modern agriculture. Another important issue of agricultural sustainability concerns competition for water, between agriculture and civil uses, industrial production and environmental needs. In addition, current climatic changes are leading to crop adaptation in stressful drought environments. The most efficient agricultural tool for achieving water saving is to improve water productivity, thereby producing more food per unit of water used. In this spirit, by comparing the effects of three irrigation treatments (100, 70 and 40% of the full irrigation requirements) on the water use efficiency (WUE) of five basil cultivars, Kalamartzis et al. [17] confirm that an appropriate cultivar choice (i.e., 'Mrs. Burns') is essential to achieving a higher WUE and may allow water resources to be saved, especially in drought areas, while also obtaining high dry weight accumulation and essential oil yield. Similarly, in an attempt to develop a water conservation strategy in drought lands, Gao et al. [18] find that the drip irrigation level of 540–600 m^3 ha^{-1}, combined with low mepiquat chloride application, may represent a good strategy in cotton to achieve higher water productivity and lint yield, thanks to improved leaf photosynthetic traits and reproductive organ biomass accumulation. According to the authors' perspective, this finding is relevant since mepiquat chloride, a growth regulator used in cotton production since 1975, affects plant structure in complex hormonal ways and, therefore, optimal mepiquat chloride schedules are difficult to identify. Interestingly, in this study, moderately reduced drip irrigation rates (540 and 480 m^3 ha^{-1}) do not significantly affect cotton fiber quality parameters, such as fiber length and uniformity, nor specific strength and micronaire values. Further to this, Chen et al. [19] highlight that pre-sowing irrigation combined with basal surface fertilization ensures the higher root morphological and physiological activity [i.e., greater root biomass, longer root length in the surface soil profile (0–30 cm) and higher root nitrate reductase activity in the surface or deep soil profile (60–80 cm) at the boll setting stage] and water-nitrogen productivity of cotton crops in arid regions. A future challenge should be how the irrigation method and scheduling can affect water-nutrient efficiency, considering that in the case of cotton, as reported by Chen et al. [19], a resource conservation strategy should balance growth and development between the aerial and underground parts of the cotton plant.

From the first steps of agriculture, a problematic aspect affecting the productivity of herbaceous field crops is certainly weed control management. Current awareness of the possible impact of chemical weeding on the environment has led to the development of integrated weed management (IWM). As described in a review from Scavo and Mauromicale [20], this represents a feasible approach, especially under organic farming and low-input agricultural systems. Scavo and Mauromicale [20], through a holistic view, present a literature and expert analysis of the different tactics (preventive, cultural, mechanical and chemical) to be adopted for effective IWM. Indeed, a single weed control measure is unlikely due to the presence of different weed species with highly diverse life cycles and survival strategies. In addition, the adoption of a singular control method enforces weed adaptability to this practice. Therefore, advancements in non-chemical weed control are inevitable if IWM is to be achieved. In particular, with a view to sustainability, the authors explore the possible integration of allelopathy for weed control. The use of cover crops for this purpose is still being studied, particularly in order to verify the best agronomic technique for exploiting their natural herbicide potential. In this sense, considering the different suppression indices of allelopathic plants, Carrubba et al. [21] study the herbicidal potential of five plant water extracts (from *Artemisia arborescens*, *Rhus coriaria*, *Lantana camara*, *Thymus vulgaris*, and *Euphorbia characias*) on durum wheat (cv. Valbelice). Although none of the tested treatments (including a chemical control) are able to eradicate weeds from the field, the lack of a significant difference in grain yield between chemically treated plots and untreated ones demonstrates that weed control with chemical herbicides does not necessarily result in a significant grain yield increase. Though not yet conclusive about which allelochemical extract exerts predictable effects on crop yield and development, Carrubba et al. [21] state the need to use a broader range of crops and allelochemicals. It is noteworthy that non-chemical weeding can minimize, but not necessarily eliminate, all weeds. The latter may even be welcomed due to their contribution of organic matter to soil during tillage. Always on wheat durum, the already cited research from Toukabri et al. [11] highlights that the mixture of fenugreek and clover, as companion plants, allows weed suppression that is comparable to herbicides in efficiency. So, intercropping with legumes can be considered effective to limit pesticide dependency and, hence, to mitigate food-related chemical hazards. Besides suppressing weeds, intercropping with legume crops is well-suited to the holistic approach of IWM, as it provides several ecosystemic services, such as improving soil organic matter content, reducing runoff and soil erosion, and minimizing dependency on external fertilizers, by fixing atmospheric nitrogen. However, the use of cover crops as a weed management tool needs to be carefully followed up throughout the growing period, unlike the use of herbicides. According to Scavo and Mauromicale [20], another important aspect of an IWM approach is the selection of genotypes able to tolerate weeds' competition while maintaining a high yield. Accordingly, Milan et al. [22] evaluate, at two experimental sites in Northern Italy, the difference between hybrid and conventional wheat cultivars in terms of response to weed pressure. This study presents interesting preliminary results on the adoption of hybrid cultivars, which needs a reconsideration of the production system. Indeed, the higher cost of seeds requires a reduction in seeding rate (by about one-third of that ordinarily adopted for conventional cultivars), which may cause delayed canopy development and, as a consequence, more bare soil that is potentially colonizable by weeds in the early stages of the growing season.

Interestingly, on fields characterized by reduced weed pressure and in the case of weed infestation mostly represented by early emerging weeds, hybrid cultivars may not be significantly affected by yield losses. However, the obtained results must be corroborated by further studies in other geographic locations and with a major number of genotypes.

A further aspect impairing the yield and quality of herbaceous field crops is harvest time, which is associated with both the product maturation stage at harvest and the climatic conditions before collection. In particular, timely harvesting is crucial to crop loss prevention, good quality and high market value for any crop. In the present special issue, two studies conducted in Greece find a variation in the chemical composition of cultivated cardoon bracts [23] and heads [24] in relation to the maturation stage. As an example, it is highlighted that the content of phenolic compounds decrease with increasing maturity as a consequence of the lignification of bracts tissues. By contrast, mature bracts present higher amounts of sugars than immature ones, due to inulin biosynthesis and carbohydrate translocation in other plant parts, such as the heads. Understanding the relationships between metabolite accumulation in the plant parts and harvest time provides useful information to increase the quality and added value of this crop for the possible extraction of phytochemical compounds. Despite ongoing progress in synthetic chemistry, natural products are more characterized by enormous scaffold diversity and structural complexity. Therefore, challenges in agricultural practices should be focused not only on yield increase but also on the maintenance and/or enrichment of the phytochemicals present in plants.

In conclusion, the current special issue includes several topics of research relative to herbaceous field crops, highlighting the importance of biodiversity and environment preservation while showing agronomic practices that are able to improve crop yield and quality. Furthermore, this special issue provides an overview of current and future challenges in the sustainable cultivation of our main herbaceous field crops.

Author Contributions: S.L. and G.M. wrote this editorial for the introduction of the Special Issue of Agronomy, entitled "Herbaceous Field Crops' Cultivation", and edited the Special Issue. All authors have read and agreed to the published version of the manuscript.

Funding: This work received no external funding.

Acknowledgments: We are grateful to all authors who submitted their valuable manuscripts to the Special Issue of Agronomy, entitled "Herbaceous Field Crops' Cultivation".

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Yadav, S.; Jackson, P.; Wei, X.; Ross, E.; Aitken, K.; Deomano, E.; Atkin, F.; Hayes, B.; Voss-Fels, K. Accelerating Genetic Gain in Sugarcane Breeding Using Genomic Selection. *Agronomy* **2020**, *10*, 585. [CrossRef]
2. Tuttolomondo, T.; Iapichino, G.; Licata, M.; Virga, G.; Leto, C.; La Bella, S. Agronomic Evaluation and Chemical Characterization of Sicilian *Salvia sclarea* L. Accessions. *Agronomy* **2020**, *10*, 1114. [CrossRef]
3. Khan, N.; Xing, F.; Feng, L.; Wang, Z.; Xin, M.; Xiong, S.; Wang, G.; Chen, H.; Du, W.; Li, Y. Comparative Yield, Fiber Quality and Dry Matter Production of Cotton Planted at Various Densities under Equidistant Row Arrangement. *Agronomy* **2020**, *10*, 232. [CrossRef]
4. Khan, A.; Zheng, J.; Tan, D.; Khan, A.; Akhtar, K.; Kong, X.; Munsif, F.; Iqbal, A.; Afridi, M.; Ullah, A.; et al. Changes in Leaf Structural and Functional Characteristics when Changing Planting Density at Different Growth Stages Alters Cotton Lint Yield under a New Planting Model. *Agronomy* **2019**, *9*, 859. [CrossRef]
5. Zaheer, S.; Arif, M.; Akhtar, K.; Khan, A.; Khan, A.; Bibi, S.; Muhammad Aslam, M.; Ali, S.; Munsif, F.; Jalal, F.; et al. Grazing and Cutting under Different Nitrogen Rates, Application Methods and Planting Density Strongly Influence Qualitative Traits and Yield of Canola Crop. *Agronomy* **2020**, *10*, 404. [CrossRef]
6. Deng, G.; Du, G.; Yang, Y.; Bao, Y.; Liu, F. Planting Density and Fertilization Evidently Influence the Fiber Yield of Hemp (*Cannabis sativa* L.). *Agronomy* **2019**, *9*, 368. [CrossRef]
7. Nadeem, M.; Tanveer, A.; Sandhu, H.; Javed, S.; Safdar, M.; Ibrahim, M.; Shabir, M.; Sarwar, M.; Arshad, U. Agronomic and Economic Evaluation of Autumn Planted Sugarcane under Different Planting Patterns with Lentil Intercropping. *Agronomy* **2020**, *10*, 644. [CrossRef]
8. Ierna, A.; Mauromicale, G. Sustainable and Profitable Nitrogen Fertilization Management of Potato. *Agronomy* **2019**, *9*, 582. [CrossRef]

9. Lombardo, S.; Pandino, G.; Mauromicale, G. Optimizing Nitrogen Fertilization to Improve Qualitative Performances and Physiological and Yield Responses of Potato (*Solanum tuberosum* L.). *Agronomy* **2020**, *10*, 352. [CrossRef]
10. Conversa, G.; Elia, A. Growth, Critical N Concentration and Crop N Demand in Butterhead and Crisphead Lettuce Grown under Mediterranean Conditions. *Agronomy* **2019**, *9*, 681. [CrossRef]
11. Toukabri, W.; Ferchichi, N.; Hlel, D.; Jadlaoui, M.; Kheriji, O.; Zribi, F.; Taamalli, W.; Mhamdi, R.; Trabelsi, D. Improvements of Durum Wheat Main Crop in Weed Control, Productivity and Grain Quality through the Inclusion of Fenugreek and Clover as Companion Plants: Effect of N Fertilization Regime. *Agronomy* **2021**, *11*, 78. [CrossRef]
12. Iqbal, B.; Kong, F.; Ullah, I.; Ali, S.; Li, H.; Wang, J.; Khattak, W.; Zhou, Z. Phosphorus Application Improves the Cotton Yield by Enhancing Reproductive Organ Biomass and Nutrient Accumulation in Two Cotton Cultivars with Different Phosphorus Sensitivity. *Agronomy* **2020**, *10*, 153. [CrossRef]
13. Ma, X.; Ali, S.; Hafeez, A.; Liu, A.; Liu, J.; Zhang, Z.; Luo, D.; Noor Shah, A.; Yang, G. Equal K Amounts to N Achieved Optimal Biomass and Better Fiber Quality of Late Sown Cotton in Yangtze River Valley. *Agronomy* **2020**, *10*, 112. [CrossRef]
14. Ronga, D.; Caradonia, F.; Parisi, M.; Bezzi, G.; Parisi, B.; Allesina, G.; Pedrazzi, S.; Francia, E. Using Digestate and Biochar as Fertilizers to Improve Processing Tomato Production Sustainability. *Agronomy* **2020**, *10*, 138. [CrossRef]
15. Kowalska, J.; Tyburski, J.; Bocianowski, J.; Krzymińska, J.; Matysiak, K. Methods of Silicon Application on Organic Spring Wheat (*Triticum aestivum* L. spp. *vulgare*) Cultivars Grown across Two Contrasting Precipitation Years. *Agronomy* **2020**, *10*, 1655. [CrossRef]
16. Lombardo, S.; Abbate, C.; Pandino, G.; Parisi, B.; Scavo, A.; Mauromicale, G. Productive and Physiological Response of Organic Potato Grown under Highly Calcareous Soils to Fertilization and Mycorrhization Management. *Agronomy* **2020**, *10*, 1200. [CrossRef]
17. Kalamartzis, I.; Dordas, C.; Georgiou, P.; Menexes, G. The Use of Appropriate Cultivar of Basil (*Ocimum basilicum*) Can Increase Water Use Efficiency under Water Stress. *Agronomy* **2020**, *10*, 70. [CrossRef]
18. Gao, H.; Ma, H.; Khan, A.; Xia, J.; Hao, X.; Wang, F.; Luo, H. Moderate Drip Irrigation Level with Low Mepiquat Chloride Application Increases Cotton Lint Yield by Improving Leaf Photosynthetic Rate and Reproductive Organ Biomass Accumulation in Arid Region. *Agronomy* **2019**, *9*, 834. [CrossRef]
19. Chen, Z.; Gao, H.; Hou, F.; Khan, A.; Luo, H. Pre-Sowing Irrigation Plus Surface Fertilization Improves Morpho-Physiological Traits and Sustaining Water-Nitrogen Productivity of Cotton. *Agronomy* **2019**, *9*, 772. [CrossRef]
20. Scavo, A.; Mauromicale, G. Integrated Weed Management in Herbaceous Field Crops. *Agronomy* **2020**, *10*, 466. [CrossRef]
21. Carrubba, A.; Labruzzo, A.; Comparato, A.; Muccilli, S.; Spina, A. Use of Plant Water Extracts for Weed Control in Durum Wheat (*Triticum turgidum* L. subsp. durum Desf.). *Agronomy* **2020**, *10*, 364. [CrossRef]
22. Milan, M.; Fogliatto, S.; Blandino, M.; Vidotto, F. Are Wheat Hybrids More Affected by Weed Competition than Conventional Cultivars? *Agronomy* **2020**, *10*, 526. [CrossRef]
23. Mandim, F.; Petropoulos, S.; Giannoulis, K.; Santos-Buelga, C.; Ferreira, I.; Barros, L. Chemical Composition of *Cynara cardunculus* L. var. *altilis* Bracts Cultivated in Central Greece: The Impact of Harvesting Time. *Agronomy* **2020**, *10*, 1976. [CrossRef]
24. Mandim, F.; Petropoulos, S.; Fernandes, Â.; Santos-Buelga, C.; Ferreira, I.; Barros, L. Chemical Composition of *Cynara cardunculus* L. var. *altilis* Heads: The Impact of Harvesting Time. *Agronomy* **2020**, *10*, 1088. [CrossRef]