**وه‌زاره‌تی خوێندنی باڵا و تۆێژینه‌وه‌ی زانستی**

 **Ministry of Higher Education &**

 **Scientific Research**

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| **پرۆپۆزەلى توێژینه‌وه‌ بۆ به‌ده‌ستهێنانی بروانامه‌ی دکتۆراPhD Research Proposal** |
| **ناونيشانی پرۆپۆزه‌لی تۆێژینه‌وه‌ی پێشنیازکراو 1. Title of PhD research proposal****Effect of different levels of Nano- Conventional NPK and plant density on growth, yield and seed quality of sunflower (*Helianthus annuus* L.)** |
| **زانیاری گشتی 2. General information** |
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| **3. introduction**  The yield of achenes and the yield components of the head are specific to each sunflower hybrid, but they are influenced by the different growing factors (environmental and technological factors). Soil and climatic conditions are among the environmental factors with a great influence on the sunflower yield. Row spacing and plant population are of great importance among the technological factors. Sunflower (*Helianthus annuus* L.) is becoming an increasingly important source of edible vegetable oil throughout the world due to its high oil content (40-52%), no cholesterol and high non saturated fatty acids content that ranged between 85-91%. In addition, the oil contains variable amounts of vitamins K, E, D and A. The by-products of the seed (seed cake) is a rich source of proteins (35%) and carbohydrates (18-20%) for animals and poultry feed. Sunflower a drought resistant crop, is cultivated widely throughout the world. Still, few studies on the fertility requirements of the crop have been published, particularly in relation to cultivation on highly weathered soils and in terms of using foliar analysis as a tool i diagnosing nutritional need. It is predicted that nanotechnology can boost agricultural production through the nano-formulations of nano-fertilizers (Sekhon, 2014), which these materials when reduced to the nano-scale display some characteristics which are different from what they exhibit on a bulk scale, facilitating unique applications. The nanoparticles have large surface area to the volume ratio, which provides better opportunity for interaction and the tools and mechanisms used in nano-fertilizers enables them to partially synchronize the nutrients release with crop requirements.  |
| 5**. Research objectives**1. Comparison between the performance of Conventional NPK fertilizer and nano NPK fertilizer and its effect on the field and quality characteristics of sunflower plant.
2. Studying the effect of the interaction between nano and Conventional NPK fertilizer and plant density in order to reduce the wastage and loss of fertilizer during spraying.

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| **6. Methodology and data collection**Effect of nano-NPK and conventioal NPK foliar application on sunflower under different plant density at two season (summer season 2020-2021 and spring season 2021-2022).Foliar application will conduct at two plant stage (30 days and 55 days after planting ). Experiment design as a factorial in RCBD with three replications and two factors, the first factor is the type and levels of fertilizer (t1= H2O , t2= 100 ppm, t3= 150 ppm and t4 =200 ppm of Nano NPK respectively) and (t5= 300 ppm, t6 =500 ppm, t7= 700 ppm for conventional NPK ) t8 = adding NPK fertilizer to the soil according to standerd recomendation) . The second factor is row spacing (at two levels, 50 and 70 cm) , but the space between seeds within row fixed on 30 cm. The area of each plot (3\*2.5 m) and the distance between each plot 75 cm. also 100 cm between blocks . In addition, the amount of water added is also calculated for each irrigation.

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|  | Levels | Erbil |
| H2O | T1 |
| Nano NPK | T2 (100 ppm) |
| T3 (150 ppm) |
| T4 (200 ppm) |
| Conventional NPK | T5 ( 300 ppm) |
| T6 (500 ppm) |
| T7 (700 ppm) |
| Recommended NPK | T8  |
| Plant density(row space)  | 50 cm (111111.11) |
| 70 cm (47619.04) |
| Replication | 3 replicates |

**Studied traits:**  ten plants per plot were randomly taken for the following measurments:

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| Days to 50% flowering | number of heads per plant |
| Days to maturity | number of seeds per head |
| plant height cm from soil surface to the base of head | Weight of sound seeds per head |
| Chlorophyll content by using SPAD or ATLEAF apparatus | Weight of shriveled seeds per head |
| leaf area  | Hull % = weight of husk/weight of seeds ×100 |
| biological yield | Seed yield per m2 then convert to kg/ha. |
| harvest index | 100-seed weight |
| Head dimeter cm  | oil content : ether extraction |
| Main stem diameter cm  | oil yield kg/ha. = seed yield x oil % |
| Number of leaves on main stem |  |
| Protein content | Protein yield kg/ha. = seed yield x protein % |
| Bulk density g/ml | NPK content befor and after spraying |
| Percentage of fertilization%=empety seeds/ total seed ×100 |  |

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| **7. Scope and limit to the research** Details of anticipated problems and proposed resolutions1. Some practical obstacles.
2. Difficulty of chemical analysis ( Lipid profile).
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| **8. Duration and timeline**Two to three Years |
| **12.** **په‌سه‌ندكردنی پرۆپۆزەل له‌ لایه‌ن لیژنه‌ی زانستی به‌ش**ژماره‌ی كۆنووسی كۆبوونه‌وه‌:رێكه‌وتی كۆبوونه‌وه‌:بریار: په‌سه‌ند كرا په‌سه‌ند نه‌كرا ناوی سیانی و واژووی لیژنه‌ی زانستی به‌ش واژوو: ناوىسه‌رۆكی لیژنەى‌ زانستی به‌ش مۆری به‌ش واژوو: ناوى سه‌رۆكی به‌ش: |
| **13.****په‌سه‌ندكردنی پرۆپۆزەل له‌ لایه‌ن ئه‌نجومه‌نی كۆلێژ/فاکەڵتى**ژماره‌ی كۆنوسی كۆبوونه‌وه‌:رێكه‌وتی كۆبوونه‌وه‌:بریار: په‌سه‌ند كرا په‌سه‌ند نه‌كرا واژوو:ناو راگری كۆلێژ:مۆری كۆلێژ |

**تێبینی:** تكایه‌ فۆرمه‌كه‌ ته‌نها به‌ یه‌ك زمان (زمانی توێژینه‌وه‌) پڕ بكرێته‌وه‌.