المجلة العربية للعلوم الزراعية

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تصدر عن
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ومركز البحوث الزراعية – جمهورية مصر العربية
برعاية أكاديمية البحث العلمي والتكنولوجيا وبنك المعرفة المصري

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المجلة العربية للعلوم الزراعية

الصادرة عن المؤسسة العربية للتربية والعلوم والآداب ومركز البحوث الزراعية

برعاية أكاديمية البحث العلمي والتكنولوجيا وبنك المعرفة المصري

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طبعت بمطابع دار المعارف – القاهرة

يتم النشر الالكتروني على المنصات الآتية


بسم الله الرحمن الرحيم

إدارة المجلة غير مسؤولة عن الأفكار والآراء الواردة بالبحوث المنشوره في أعدادها
وإنما فقط تقع مسؤوليتها في التحكيم العلمي والضوابط الأكاديمية

هيئـــــــــة التحريـــــــــر

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ميثاق اخلاقيات النشر :

تنشر المؤسسة العربية للتربية والعلوم والآداب من خلال اصداراتها البحوث العلمية الأصيلة والمحكمة، بهدف توفير جودة عالية لقُرَّائها من خلال الالتزام بمبادئ مدونة أخلاقيات النشر و منع الممارسات الخاطئة. وتصنف المدونة الأخلاقية ضمن لجنة أخلاقيات النشر (COPE Committee on Publication Ethics :) وهي الأساس المرشد للمؤلفين والباحثين والأطراف الأخرى المؤثرة في نشر البحوث بالمجلات من مراجعين، بحيث تسعى المجلات لوضع معايير موحّدة للسلوك؛ وترغب المجلات على أن يقبل الجميع بقوانين المدونة الأخلاقية، وبذلك فهي ملتزمة تماما بالحرص على تطبيقها في ظل القبول بالمسؤولية والوفاء بالواجبات والمسؤوليات المسندة لكل طرف.

١- مسؤولية الناشر:

قرار النشر: يجب مراعاة حقوق الطبع وحقوق الاقتباس من الأعمال العلمية السابقة، بغرض حفظ حقوق الآخرين عند نشر البحوث بالمجلات، و يعتبر رئيس التحرير مسؤولا عن قرار النشر والطبع ويستند في ذلك إلى سياسة المجلات والتقيد بالمتطلبات القانونية للنشر، خاصة فيما يتعلق بالتشهير أو القذف أو انتهاك حقوق النشر والطبع أو القرصنة، كما يمكن لرئيس التحرير استشارة أعضاء هيئة التحرير أو المراجعين في اتخاذ القرار.

النزاهة: يضمن رئيس التحرير بأن يتم تقييم محتوى كل مقال مقدم للنشر، بغض النظر عن الجنس، الأصل، الاعتقاد الديني، المواطنة أو الانتماء السياسي للمؤلف.

السرية: يجب أن تكون المعلومات الخاصة بمؤلفي البحوث سرية للغاية وأن يُحافظ عليها من قبل كل الأشخاص الذين يمكنهم الاطلاع عليها، مثل رئيس التحرير، أعضاء هيئة التحرير، أو أي عضو له علاقة بالتحرير والنشر وباقي الأطراف الأخرى المؤتمنة حسب ما تتطلب عملية التحكيم.

الموافقة الصريحة: لا يمكن استخدام أو الاستفادة من نتائج أبحاث الآخرين المتعلقة بالبحوث غير القابلة للنشر بدون تصريح أو إذن خطي من مؤلفها.

٢- مسؤولية المحكم (المراجع) :

المساهمة في قرار النشر: يساعد المحكم (المُراجع) رئيس التحرير وهيئة التحرير في اتخاذ قرار النشر وكذلك مساعدة المؤلف في تحسين البحث وتصويبه.

سرعة الخدمة والتقيد بالآجال: على المحكم المبادرة والسرعة في القيام بتقييم البحث الموجه إليه في الآجال المحددة، وإذا تعذر ذلك بعد القيام بالدراسة الأولية للبحث، عليه إبلاغ رئيس التحرير بأن موضوع البحث خارج نطاق عمل المحكم، تأخير التحكيم بسبب ضيق الوقت أو عدم وجود الإمكانيات الكافية للتحكيم.

السرية: يجب أن تكون كل معلومات البحث سرية بالنسبة للمحكم، وأن يسعى المحكم للمحافظة على سريتها ولا يمكن الإفصاح عليها أو مناقشة محتواها مع أي طرف باستثناء المرخص لهم من طرف رئيس التحرير.

الموضوعية : على المحكم إثبات مراجعته وتقييم الأبحاث الموجهة إليه بالحجج والأدلة الموضوعية، وأن يتجنب التحكيم على أساس بيان وجهة نظره الشخصية، الذوق الشخصي، العنصري، المذهبي وغيره.

تحديد المصادر: على المحكم محاولة تحديد المصادر والمراجع المتعلقة بالموضوع (البحث) و التي لم المؤلف، و أي نص أو فقرة مأخوذة من أعمال أخرى منشوره سابقا يجب تهميشها بشكل صحيح، وعلى المحكم إبلاغ رئيس التحرير وإنذاره بأي أعمال متماثلة أو متشابهة أو متداخلة مع العمل قيد التحكيم.

تعارض المصالح: على المحكم عدم تحكيم البحوث لأهداف شخصية، أي لا يجب عليه قبول تحكيم البحوث التي عن طريقها يمكن أن تكون هناك مصالح للأشخاص أو المؤسسات أو يُلاحظ فيها علاقات شخصية.

٣- مسؤولية المؤلف :

معايير الإعداد: على المؤلف تقديم بحث أصيل وعرضه بدقة وموضوعية، بشكل علمي متناسق يطابق مواصفات البحوث المحكمة سواء من حيث اللغة، أو الشكل أو المضمون، و ذلك وفق معايير و سياسة النشر في المجلات، وتبيان المعطيات بشكل صحيح، و ذلك عن طريق الإحالة الكاملة، ومراعاة حقوق الآخرين في البحث ؛ وتجنب إظهار المواضيع الحساسة وغير الأخلاقية، الذوقية، الشخصية، العرقية، المذهبية، المعلومات المزيفة وغير الصحيحة وترجمة أعمال الآخرين بدون ذكر مصدر الاقتباس في البحث.

الأصالة و القرصنة: على المؤلف إثبات أصالة عمله وأي اقتباس أو استعمال فقرات أو كلمات الآخرين يجب تهميشه بطريقة مناسبة وصحيحة ؛ والمجلة تحتفظ بحق استخدام برامج اكتشاف القرصنة للأعمال المقدمة للنشر.

إعادة النشر: لا يمكن للمؤلف تقديم العمل نفسه (البحث) لأكثر من مجلة أو مؤتمر، وفعل ذلك يعتبر سلوك غير أخلاقي وغير مقبول.

الوصول للمعطيات والاحتفاظ بها: على المؤلف الاحتفاظ بالبيانات الخاصة التي استخدمها في بحثه، و تقديمها عند الطلب من قبل هيئة التحرير أو المُقيّم.

مؤلفي البحث: ينبغي حصر (عدد) مؤلفي البحث في أولئك المساهمين فقط بشكل كبير وواضح سواء من حيث التصميم، التنفيذ، مع ضرورة تحديد المؤلف المسؤول عن البحث وهو الذي يؤدي

دوراً كبيراً في إعداد البحث والتخطيط له، أما بقية المؤلفين يُذكرون أيضاً في البحث على أنّهم مساهمون فيه فعلا، ويجب أن يتأكد المؤلف الأصلي للبحث من وجود الأسماء والمعلومات الخاصة بجميع المؤلفين، وعدم إدراج أسماء أخرى لغير المؤلفين للبحث ؛ كما يجب أن يطّلع المؤلفون جميعا على البحثة جيدا، وأن يتفقوا صراحة على ما ورد في محتواها ونشرها بذلك الشكل المطلوب في قواعد النشر.

الإحالات والمراجع: يلتزم صاحب البحث بذكر الإحالات بشكل مناسب، ويجب أن تشمل الإحالة ذكر كلِّ الكتب، المنشورات، المواقع الإلكترونية و سائر أبحاث الأشخاص في قائمة الإحالات والمراجع، المقتبس منها أو المشار إليها في نص البحث.

الإبلاغ عن الأخطاء: على المؤلف إذا تنبّه و أكتشف وجود خطأ جوهرياً و عدم الدقة في جزئيات بحثه في أيّ زمن، أن يشعر فورا رئيس تحرير المجلات أو الناشر، ويتعاون لتصحيح الخطأ.

شـــــــروط النشـــــــر :

- يجب أن لا يتجاوز البحث المقدم للنشر عن (٣٥) صفحة ، متضمنة المستخلصين : العربي ، والإنجليزي على أن لا تتجاوز كلمات كل واحد منهما (٢٠٠) كلمة ، والمراجع.
- يلي المستخلصين : العربيَّ ، والإنجليزيَّ ، كلماتٌ مفتاحية (Key Words) لا تزيد على خمس كلمات (غير موجودة في عنوان البحث)، تعبر عن المجالات التي يتناولها البحث؛ لتستخدم في التكشيف.
- تكون أبعاد جميع هوامش الصفحة الأربعة (العليا، والسفلى، واليمنى، واليسرى) (٣) سم، والمسافة بين الأسطر مفردة.
- يكون نوع الخط في المتن للبحوث العربية وللبحوث الإنجليزية (Times New Roman)، بحجم (١٣).
- يكون نوع الخط في الجداول للبحوث العربية وللبحوث الإنجليزية (Times New Roman)، بحجم (١٠).
- تستخدم الأرقام العربية (١-٢-٣...Arabic) في جميع ثنايا البحث.
- يكون ترقيم صفحات البحث في منتصف أسفل الصفحة.
- يكتب عنوان البحث ، واسم الباحث ، أو الباحثين ، والمؤسسة التي ينتمي إليها، وعنوان المراسلة، على صفحة مستقلة قبل صفحات البحث. ثم تتبع بصفحات البحث، بدءاً بالصفحة الأولى حيث يكتب عنوان البحث فقط متبوعاً بكامل البحث.

- يراعى في كتابة البحث عدم إيراد اسم الباحث، أو الباحثين، في متن البحث صراحة، أو بأي إشارة تكشف عن هويته، أو هوياتهم، وإنما تستخدم كلمة (الباحث، أو الباحثين) بدلاً من الاسم، سواء في المتن، أو التوثيق، أو في قائمة المراجع.
- أسلوب التوثيق المعتمد في المجلة هو نظام جمعية علم النفس الأمريكية، الإصدار السادس.
- يتأكد الباحث من سلامة لغة البحث، وخلوه من الأخطاء اللغوية والنحوية.
- توضع قائمة بالمراجع العربية بعد المتن مباشرة، مرتبة هجائياً حسب الاسم الأول أو الأخير للمؤلف (اختياري) ، وفقاً لأسلوب التوثيق المعتمد في المجلة.
- لهيئة التحرير حق الفحص الأوّلي للبحث، وتقرير أهليته للتحكيم، أو رفضه.
- في حال قبول البحث للنشر تؤول كل حقوق النشر للمجلة، ولا يجوز نشره في أي منفذ نشر آخر ورقياً أو إليكترونياً، دون إذن كتابي من رئيس هيئة التحرير.
- الآراء الواردة في البحوث المنشورة تعبر عن وجهة نظر الباحثين فقط، ولا تعبر بالضرورة عن رأي المجلة.
- يحق للباحث استلام نسخة ورقية من العدد ، وعند طلب نسخ أخرى أو مستلات اضافية للبحث أو ارساله بريدياً يتم تسديد تكلفتهم مع رسوم النشر.
- يتم تقديم البحوث إلكترونياً من خلال موقع المجلة أو البريد الإلكتروني:

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محتويات العـدد

افتتاحية العدد :

مع إصدار العدد الجديد تسعى هذه المجلة جاهدة لتحقيق التميز والتخصص في الميادين التي تبتغي كشف معالمها واكتناه مجاهلها. فالمجلة تنذر دفتيها لاستعاب حصاد ما ينبت من بحث علمي جاد في مجال البحوث الزراعية. فالبحث العلمى هو الأساس فى بناء الدول المتقدمة و بدونه لا تحدث أى تنمية أو تطور فى المجتمعات الحديثة و تحقيق معدلات تنمية عالية على المستوى البشرى و استغلال الموارد المتاحة فى تحقيق عوائد اقتصادية مرتفعة تعود بالنفع على المجتمع و الدولة و من خلال هذة المجلة نطرح أهم البحوث التى تعمل على زيادة المحاصيل الحقلية لسد الاحتياجات الغذائية المستمرة و زيادة التوسع الرأسى و الأفقى و الذى يشمل العديد من الخطوات منها زراعة تقاوى الأصناف و الهجن المحسنة العالية الأنتاج و التى تتميز بمقاومتها للأمراض و تحملها للظروف البيئية و تطبيق أفضل المعاملات الزراعية للأصناف والهجن المزروعة .

وايضا من خلال هذه المجلة نتناول البحوث التى تتعلق بتشخيص مسببات الأمراض للحيوانات و الطيور و طرق الوقاية منها و البحوث التى تتعلق بسبل زيادة النمو و الانتاج و زيادة الخصوبة مما يعود بتوفير البروتين الحيوانى و الداجنى لمواجهة الاحتياجات المستمرة له نظرا للزيادة السكانية .

وحرصا من هيئة تحرير المجلة على المستوى العلمى لها سوف يتم نشر البحوث المتميزة لتكون منارة جديدة للمتخصصين الباحثين العرب من مختلف أرجاء الوطن العربى الكبير من الخليج الى المحيط . واذ ندعو الباحثين الراغبين فى نشر بحوثهم بها الالتزام بمعايير النشر بالمجلة و الحرص على اجراء التعديلات و الملاحظات التى يبديها المحكمين و نأمل لأن تكون الأعداد القادمة من المجلة أكثر ثراءا و جدة بفضل الله و عونه و الله ولى التوفيق . ومرحبا بوجهة نظركم و رأيكم فى أى فكرة تسهم فى الرقى و التطور لمجلتكم التى تعد صورة من صور التعبير عن أشخاصكم و مرحبا بالنقد البناء فى أى جانب و بمقترحاتكم لتحقيق الرقى الدائم و التطوير المستمر لمجلتكم الغراء .

وختاماً نقدم هذا العدد للقارئ الكريم متمنيين أن يجد فيه الفائدة المرجوة وفق الله الجميع لما فيه الخير و السداد و أخر دعوانا ان الحمد لله رب العالمين

هيئة التحرير

تأثير عملية التمليح الجاف في التركيب الكيميائي وبعض الخواص الفيزيائية للحم الماعز الجبلي

The Effect of Dry Salting Process on the Chemical Composition and some Physical properties of Goat meat

اعداد

محمود مصطفى عبد الكريم

مشرف أعمال في كلية الهندسة الزراعية، جامعة حلب، حلب، سوريا

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المستخلص :

أجريت هذه الدراسة في كلية الزراعة، جامعة حلب وقد هدف البحث لدراسة تأثير عملية التمليح الجاف في التركيب الكيميائي والخواص الفيزيائية للحم الماعز الجبلي المتوفر في السوق المحلية لمدينة حلب، حيث أجريت الدراسة على العضلة الطويلة الظهرية، حيث يتبن من النتائج المتحصل عليها وجود ارتفاع معنوي في نسبة الرطوبة في عينة الشاهد وذلك عند مستوى معنوية $P<0.05$ مقارنةً بالعينات المملحة، كما يتبين أن عملية التمليح أدت لانخفاض نسبة البروتين الكلي نتيجة خروج جزء من المواد الآزوتية البسيطة خلال عملية التمليح، وجد من خلال الدراسة أن التمليح يؤدي لانخفاض معنوي في نسبة الفقد خلال عملية السلق، كما لوحظ أن التمليح يزيد من قدرة اللحم على ربط الماء وان هذه الزيادة كانت معنوية مقارنةً بالشاهد وذلك لأن عملية التمليح ترفع من قدرة البروتينات على ربط الماء، كما وجد أن التمليح يحسن من قوام اللحم ويزيد من صلابته وتماسكه مقارنةً بالشاهد، لوحظ كذلك أن التمليح يحسن من الصفات الحسية للحم ويجعله اكثر قبولاً لدى المستهلك مقارنةً باللحم غير المملح.

الكلمات المفتاحية: لحم الماعز الجبلي السوري، التمليح، العضلة الظهرية المستطيلة، السلق.

Abstract:

His study was conducted the aim of the research was to study the effect of dry salting and wet salting in the chemical

composition, nutritional value and physical properties of mountain goat meat available in the local market of Aleppo, where the study was conducted on the long dorsal muscle, where it is found from the results obtained It has a significant increase in the percentage of moisture in the control sample, at a significant level, at the level of significance P <0.05 compared to salted samples, as it turns out that the salting process resulted in a decrease in the total protein percentage due to the exit of a portion of the simple nitrogenous substances during the salting process, it was found through the study that salting It leads to a significant decrease in the percentage of loss during the boiling process, as it was noted that salting increases the ability of meat to bind to water and that this increase was significant compared to the witness, because the salting process increases the ability of proteins to bind water, and it was found that salting improves the strength of the meat and increases Its hardness and tenacity compared to the witness, it was also noted that salting improves the sensory qualities of meat and makes it more acceptable to the consumer compared to unsalted meat..

Key words: Goat meat, salting, Longissimus Doris, boiling

المقدمة والدراسة المرجعية:

أن توفير الغذاء الصحي ذي النوعية التركيبية الجيدة والمتميز بصفات حسية عالية تلبي حاجة المواطنين ورغباتهم على اختلاف أذواقهم، أصبحت من أولويات مهام المؤسسات الإنتاجية والعلمية وعلى عاتق العاملين في مجال انتاج الغذاء وتصنيعه وحفظه، والعاملين والباحثين في هذا المضمار تقع مهمة الاستفادة من التطور التقني الحديث، والتعمق فيه بتوسيع الاختصاصات ونشر الأبحاث العلمية ذات الطابع التطبيقي منها (محيو، ١٩٩٨). تعد اللحوم ذات أهمية خاصة، فهي إحدى المنتجات الرئيسية التي يعتمد عليها الانسان في تغذيته، وهي مصدر أساسي للبروتينات عالية القيمة الغذائية والتي تعتبر المادة الأساسية لنمو الانسان وبناء جسمه وأنسجته المختلفة (محيو،١٩٩٨). إن نقص الموارد من لحوم الأغنام والأبقار التي تعد المصدر الأول والأهم للحوم الحمراء، وجه الأنظار للاعتماد على لحوم الماعز

كأحد المصادر الهامة لسد النقص الحاصل في تلك الموارد، إضافةً إلى أن تربية الماعز تعد مصدراً هاماً للحصول على الحليب ومنتجاته، وبالرغم من ذلك إلا أنها لم تحظ بالدراسة الكافية الهامة كباقي الحيوانات مثل الأبقار والأغنام، لذلك فإن التوجه للاهتمام بدراسة لحم الماعز يعد أمراً ضرورياً لتطوير انتاجها وتحسين خواصها لتساهم بتوفير قسط مهم من اللحوم والألبان سعياً وراء تحقيق الاكتفاء الذاتي (محمد خيري،١٩٩٨). ويمكن القول على الصعيد المحلي أن مستقبل لحم الماعز كمصدر لأحد المغذيات الهامة لا جدال فيه، فلحوم الماعز لها خصائص تغذوية ووظيفة مميزة، إضافةً لقدرتها على الاستفادة من مجموعة واسعة من المواد النباتية التي لا تلقى قبولاً لدى الأغنام والأبقار.

اللحوم عبارة عن مجموعة من النسج العضلية والضامة والدهنية، إضافة لبعض الغدد والأعضاء الداخلية (الكبد – القلب – الطحال – اللسان –الكلى – المخ .....إلخ) تؤخذ اللحوم من ذبائح الحيوانات الصالحة للاستهلاك شريطة خلوها من الآفات والأمراض، ومن هذا التعريف يتضح أن ذبيحة الحيوان الزراعي تتضمن مجموعة من النسج المتباينة في خواصها وأهميتها الغذائية والتصنيعية وعلى رأسها النسيج العضلي الهيكلي الذي يشكل أكثر من ٥٠% من وزن الذبيحة، كما أن تركيبه يمتاز بالقيمة الغذائية والحيوية العالية من حيث نسبة البروتين ونوعيته وطعمه، وهو مهم جداً من الناحية التصنيعية، فعلى خواصه تتوقف خواص ومواصفات معظم المصنعات اللحمية(محيو، ١٩٩٨، الأسود، ١٩٨٠). حيث تتراوح نسبة البروتينات فيه ما بين ١٨-٢٢% تضم في تركيبها معظم الأحماض الأمينية الضرورية، كما تحتوي اللحوم على مجموعة الفيتامينات الذوابة في الدهون (A-D-E-K) ومجموعة فيتامينات B، وقد يتوفر فيتامين C، في المنتجات اللحمية المصنعة نتيجة إضافة حمض الاسكوربيك، كما تحتوي على نسبة من الأملاح المعدنية بين (٠,٨%-١,٢%)أهمها البوتاسيوم والفوسفور والحديد، ونسبة أقل من الزنك والمغنيزيوم والنحاس والفلور والبروم واليود، وتزداد نسبة كلوريد الصوديوم في اللحوم المصنعة نتيجة إضافته أثناء التصنيع (الزلاقي،٢٠٠٠، محيو، ١٩٩٨). ينتمي الماعز إلى صف الثدييات ورتبة ذوات الظلف وإلى العائلة البقرية وتحت عائلة الأغنام والماعز وجنس الماعز. وبوجه عام تتشابه الماعز مع الأغنام في كثير من الصفات التشريحية والفيزيولوجية (القس وآخرون،١٩٨٢). يوجد الكثير من سلالات الماعز في الوطن العربي من أهمها الماعز النوبي والشامي والنيلي والصومالي وماعز ثمود الأبيض والصحراوي والجبلي والبور والأنكورا، وينتمي الماعز الجبلي السوري من حيث الصفات الشكلية إلى سلالة الماعز مسترخية الأذن ذات القرون، وهي ذات لون أسود غالباً وبعض الحيوانات لونها أبيض، كما توجد أفراد ذات لون أبيض أو بني فاتح

أسفل البطن، والأذن طويلة ومتدلية والقرون متوسطة الطول في الإناث وطويلة في الذكور والأرجل متوسطة الطول، يبلغ وزن الذكر نحو ٥٥ كغ والأنثى ٤٠ كغ (القس وآخرون،١٩٨٢، البربري،٢٠٠٦). لدى مقارنة التركيب الكيميائي العام للنسيج العضلي للحم الماعز مقارنةً بلحوم الحيوانات الزراعية الأخرى، تبين احتواء لحم الماعز على نسبة رطوبة وصلت حتى ٧٧%، وهي أعلى من رطوبة لحم الجمل والغنم والبقر، ومتقاربة مع لحم الدجاج لكنه تميز بانخفاض نسبة الدسم فيه، لوحظ أيضاً وجود بعض الاختلافات في نسب الرماد بين لحوم الحيوانات الزراعية، حيث كانت نسبته في لحم الماعز ٠,٨٧% بينما بلغت ١,١% في لحم الجمل و٠,٩% في لحم البقر و١,٢% في لحم الغنم و١% في الدجاج (Casey,1992, Mahgoub *et al*,2012)

تتشابه نسب الأحماض الأمنية في لحم الماعز مع نظيراتها في لحوم الأبقار والأغنام والخنزير، ويعد لحم الماعز مصدر غني للأحماض الأمنية وخاصة الضرورية منها، فهو يحتوي على مستويات من أحماض الثريونين والمثيونين والليوسين والايزوليوسين والتربتوفان أعلى مما هو موجود في لحم البقر والضأن. وجد أيضاً أن كمية الأحماض الأمينية الأساسية الموجودة في لحم الماعز كافية لتغطية الاحتياجات اليومية للإنسان البالغ وخاصة فيما يتعلق بالحمض بالليسين والتربتوفان، لوحظ كذلك أن نسبة الحمض الأميني الفينيل الانين والتريوزين في لحم الماعز أقل من لحم الضأن والبقر والخنزير، كما تبين أن نسبة الحمض الأميني الأرجينين (نصف الضروري) في لحم الماعز أعلى من لحوم الحيوانات الأخرى في حين كانت نسبة الهيستادين أقل مما كانت عليه في لحوم الحيوانات الزراعية الأخرى (casey,1992). التمليح هو عبارة عن عملية نفوذ انتشاري تحت تأثير الضغط الاسموزي والميكانيكي لتراكم مواد التمليح في الناتج وتتكون القوة المحركة نتيجة الفرق في تركيز مواد التمليح بين اللحم والمحلول الملحي كما أن الرطوبة العالية ورفع درجة الحرارة يزيد من سرعة النفاذية، كما يعطي الناتج طعما ونكهتا ولوناً مميزاً بفعل العمليات الحيوية للأحياء الدقيقة والانزيمات وهو عملية حفظية وتقنية بآن واحد، غالباً ما تستخدم طريقة التمليح الرطب باستعمال محاليل ملحية (كلوريد الصوديوم) بتراكيز تتراوح ما بين ١٧-٢٣% حيث يتحقق توزيع متجانس للشوارد الملحية داخل القطعة وعلى سطحها إضافة إلى رفع كمية الناتج لامتصاصه جزء من رطوبة المحلول كما تتم عملية التمليح لوقت قصير نسبياً، لكن يلاحظ ان القدرة الحفظية تكون أضعف من مثيلتها عند استخدام الطريقة الجافة، وفي بعض الحالات تستخدم طريقة التمليح الجاف بنثر الملح على سطح القطع (في حالة تمليح وحفظ قطع اللحوم مرتفعة الدهون او المجففة جزئياً) ، لكن يعاب على هذه الطريقة طول فترة

التمليح وعدم التجانس في توزع الملح وفقد أكبر في العصير اللحمي. نتيجة للتغيرات الكيماوية المعقدة التي تحدث في اللحم أثناء التمليح (خاصة عندما يستغرق فترة طويلة) يصبح اللحم أكثر طراوة وتتراكم في اللحم ومحلول التمليح أنواع متعددة من مركبات الطعم والنكهة التي تنشأ عن العمليات الحيوية للأحياء الدقيقة والأنزيمات، وفي حالة تمليح اللحم الطازج بعد الذبح مباشرة يفضل إضافة مواد النكهة في محلول التمليح أو خليطه، وبغض النظر عن التحلل الجزئي للمواد البروتينية أثناء عملية التمليح فإنه لا يحدث تفكك في قوام الألياف العضلية، إنما تزداد قابلية الأنسجة للانتفاخ (محيو، ١٩٩٨). دلت الدراسات على وجود انخفاض معنوي في نسب الفقد خلال الطبخ في السائل الناضج والفقدان عند الإذابة في عينات لحم الفخذ والمغمورة في تراكيز مختلفة من المحاليل الملحية ومحاليل المستخلصات الأنزيمية مقارنة مع عينات اللحم المعاملة مع الماء المقطر (الأنبار، ٢٠١٢).

أهداف البحث:

تعد اللحوم من أهم المغذيات الواجب توفرها في الوجبة الغذائية وذلك لاحتوائها على نسبة عالية من البروتينات مرتفعة القيمة الحيوية بالإضافة لخواصها الحسية المرغوبة، حيث تعتبر عملية التمليح من أهم الخطوات التي تجري على اللحوم ومنتجاتها وعلى هذه الخطوة تتوقف الخواص الوظيفية للمنتج اللحمي من عصيرية وطراوة وطعم ونكهة بالإضافة لدور التمليح في المردود للمنتج النهائي ودوره الحفظي لذا فإن البحث يهدف إلى:

٢-١ -دراسة تأثير التمليح الجاف في الخواص الكيميائية والقيمة الغذائية للحم الماعز الجبلي

٢-٢ - دراسة تأثير التمليح الجاف في الخواص الفيزيائية والحسية للحم الماعز الجبلي

مواد وطرائق البحث:

خضعت للبحث عينات من النسيج العضلي للحم الماعز المتوفر في السوق المحلية (وذلك من العضلة الطويلة الظهرية) Longissimus Dorisالواقعة بين الفقرات ٩-١٣ (ذكر بعمر حوالي سنة) بعد تخليصها من الأنسجة الضامة والدهنية الواضحتين.

عملية التمليح: تم عمل شرائح من العضلة الطويلة الظهرية بأبعاد ١×٥×٥سم

التمليح الجاف تم برش الملح بنسبة ٢% على شرائح اللحم

حفظت العينات لمدة يوم واحد في البراد على درجة حرارة ٤مْ

تم سلق الشرائح على درجة حرارة ٩٠-٩٥مْ ولمدة ٣٠ دقيقة وذلك بغمرها بكمية محددة من الماء.

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الاختبارات الكيميائية والفيزيائية:

١-تقدير المحتوى الرطوبي بالتجفيف على درجة حرارة ١٠٥مْ حتى ثبات الوزن (AOAC2000)

٢ - تقدير البروتين الكلي بطريقة كلداهل وذلك بهضم العينة بوساطة حمض الكبريت المركز مع التسخين ثم اجراء عملية التقطير واستقبال المتقطر بدورق يحوي على حمض البوريك ٣% ثم المعايرة بحمض كلور الماء ٠,١ع بوجود كاشف تازيرو (AOAC2000).

٣- تقدير نسبة الملح بطريقة مور (AOAC2000)

٤- اختبارات القوام وشملت قوة القطع باستخدام سكين Light Knife Blade (L B K)Perspex وقدرت وفق المعطيات التالية:

سرعة القطع: ٢ملم/ثا. مسافة القطع: ١٠ ملم. وحسبت مقاومة القطع من خلال أعلى قراءة سجلها الجهاز كغ/سم^2 (باستخدام جهاز Texture Analyzer Stable (Microsystems.TA.XT2) (Barrett *et al*,1998)

٥- تحديد نسبة الماء المنفصل بطريقة (Graw and Hamm)بحساب الفرق في الوزن قبل وبعد الضغط على العينة بوزن ١كغ لمدة ١٠ دقائق (Graw and Hamm,1965).

٦- تقدير الفقد بالسلق بحساب الوزن قبل السلق والوزن بعد السلق.

٧- الاختبارات الحسية: قيمت الصفات الحسية باستخدام نظام الخمس نقاط وشملت تقييم الطعم والقوام (Rauscher,1996).

٨-التحليل الإحصائي: أجري تحليل التباين وحساب قيمة أقل فرق معنوي (L.S.D) على مستوى معنوية ٥% باستخدام برنامج Anova (نجار وآخرون،١٩٨١).

النتائج والمناقشة:

يتضح من الجدول رقم (١) الذي يبين نسبة الرطوبة والبروتين والملح في العينات المدروسة النيئة، أن رطوبة العينات النيئة المملحة بالطريقة الجافة قد انخفضت وبشكل معنوي مقارنةً بالشاهد، هذا يعود إلى أن إضافة الملح أدى لخروج جزء من رطوبة المنتج نتيجة فرق الضغط الاسموزي بين داخل الخلايا وخارجها بالإضافة إلى أن دخول الملح لداخل الخلية أدى لزيادة نسبة المكونات الصلبة على حساب انخفاض نسبة الرطوبة.

جدول رقم (١) نسبة الرطوبة والبروتين والملح في العينات النيئة

العينات / المكون	الرطوبة%	البروتين الكلي%	الدهن%	نسبة الملح%
الشاهد	٧٥,٥٦a	٢١,٢٤a	١,٨٣a	٠,١٦b
عينات تمليح جاف	٧٣,١١b	٢٠,٩٧b	١,٨٦a	١,٩٣a
LSD 0.05	١,١٨٨	٠,٣١٨	٠,١٤٤	٠,٠٧٦

الأحرف المتشابهة تدل على عدم وجود فروق معنوية بين العينات المدروسة

كما يلاحظ من الجدول نفسه انخفاض معنوي في نسبة البروتين لعينة التمليح الجاف مقارنةً بالشاهد أي أن إضافة الملح على شكل جاف من الممكن أن يكون قد أدى لخروج جزء من المواد الآزوتية البسيطة مع العصير الخلوي مما تسبب بانخفاض نسبة البروتين الكلي على أساس وزن العينة. أما فيما يتعلق بنسبة الدهن فيلاحظ ان نسبة الدهن لم تتأثر بشكل معنوي خلال عملية التمليح وأن الارتفاع البسيط في نسبتها في اللحم المملح كان على حساب انخفاض نسبة الرطوبة وهذا يعود لكون الدهن غير ذواب وبالتالي لم يحدث فقد في الدهن مع العصير الخلوي المفقود خلال عملية التمليح الجاف كما يلاحظ من النتائج المتحصل عليها أن نسبة الملح في العينات المملحة كانت أعلى وبفرق معنوي عن الشاهد وهذا يعود لإضافة الملح للعينات النيئة.

جدول رقم (٢) نسبة الرطوبة والبروتين في العينات المسلوقة

العينات / المكون	الرطوبة%	البروتين الكلي%	البروتين الكلي % من المادة الجافة
الشاهد	٦٢,٤٣b	٣٠,٥٤a	٨١,٢٨
عينات تمليح جاف	68.15a	28,77b	٩٠,٣٢
LSD 0.05	0,990	1,248	

الأحرف المتشابهة تدل على عدم وجود فروق معنوية بين العينات المدروسة

يتضح من الجدول رقم (٢) ارتفاع في نسبة البروتين للعينات المطهية وبشكل كبير مقارنةً بالعينات النيئة وهذا يعود لفقدان نسبة كبيرة من وزنها نتيجة الدنترة وانفصال كمية كبيرة من العصارة اللحمية الأمر الذي أدى لزيادة تركيز البروتين فيها، لكن لوحظ أن نسبة البروتين في العينات المملحة أقل وبفرق معنوي عن الشاهد وهذا يعود لكون نسبة الفقد في الرطوبة نتيجة الطهي في العينات المملحة أقل منها في الشاهد، الأمر الذي أدى لانخفاض البروتين على أساس الوزن الكلي، أما لو تم حساب نسبة

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البـروتين مـن المـادة الجافـة فـيلاحظ ارتفـاع نسـبة البـروتين فـي العينـات المملحـة والمسلوقة مقارنةً بالشاهد.

يلاحظ من الجدول رقم (٣) أن قدرة اللحم غير المملح على ربط الماء كانت ضعيفة مقارنـةً بـاللحم المملـح بالطريقـة الجافـة وذلـك لأن عمليـة التمليـح ترفـع مـن قـدرة البروتينات على الارتباط مع الماء بقوة بالإضافة لحدوث الدنترة التجمعية للبروتينات والتي أدت لزيادة قدرتها على ربط الماء.

جدول رقم (٣) نسبة الماء المرتبط % من وزن العينة ومن الماء الكلي في العينات النيئة

العينات / المكون	النسبة المئوية للماء المرتبط من وزن العينة%	النسبة المئوية للماء المرتبط من الماء الكلي
الشاهد	٥١,٣٦b	٦٧,٩٧
عينات تمليح جاف	61.23a	83,75
LSD 0.05	٢,٧٠٤٢	

الأحرف المتشابهة تدل على عدم وجود فروق معنوية بين العينات المدروسة

يعد القوام أحد أهم عوامل الجودة الحسية للحوم فهو معيار من معايير طزاجة اللحم، ويعطي فكرة واضحة عن طراوة اللحم وعصيريته وقدرته على ربط الماء والتي تعد من أهم الصفات النوعية للحم ومنتجاته، ويعد تقدير قوة مقاومة القطع والاختراق والمرونة من أهم المعايير الدالة على قوام اللحم وطراوته.

جدول رقم (٤) مقاومة القطع والفقد في السلق للعينات المدروسة

المكون / المعاملة	قوة القطع كغ/سم^2	النسبة المئوية للفقد بالسلق%
الشاهد	١,56b	٣١,٧٥a
عينات تمليح جاف	2,24a	١٧,١٩b
LSD 0.05	٠,١٢٧	١,٠٥٦

الأحرف المتشابهة تدل على عدم وجود فروق معنوية بين العينات المدروسة

يتضح من الجدول رقم (٤) أن مقاومة القطع كانت أعلى وبشكل معنوي في اللحم المملح مقارنةً بالشاهد وهذا يعود إلى أن إضافة الملح زاد من قدرة المنتج على ربط الماء وجعله أكثر تماسكاً وصلابة، بالإضافة لحدوث دنترة تجميعية للبروتينات، ويمكن تفسير هذه النتائج على أن الملح يساعد على احداث ارتباط قوي للماء مع باقي

مكونات اللحم وخاصةً البروتينات وبالتالي تخفيف أثر الدنترة الحرارية التجميعية على البروتينات واحتفاظها بمقدار أكبر من العصير اللحمي.

جدول رقم (٥) نتائج الاختبارات الحسية لعينات اللحم المسلوقة

العينة / الصفة	شاهد	تمليح جاف
الطعم	٢,٦٥	٣,٩٥
القوام	٢,٧٨	٤,٣٥

يتضح من الجدول رقم (٥) أن العينة المملحة تمليح جاف قد حازت أفضل تقدير للقوام، أما قوام الشاهد فكان ضعيفاً مقارنةً بالعينات المملحة. أما من حيث الطعم فإن عينة التمليح الجاف كان طعمها أكثر وضوحاً أما الشاهد فكان طعمه غير واضح نتيجة خسارة جزء كبير من مائه الذي يحتوي على جزء من مواد الطعم والمركبات البسيطة المنحلة في ماء السلق بالإضافة للدنترة التجميعية القاسية نسبياً بالمقارنة بالعينات المملحة.

الاستنتاجات

اعتماداً على النتائج المتحصل عليها في هذا البحث يمكن استنتاج مايلي:

١- عملية التمليح الجاف تؤدي لخفض نسبة الرطوبة في اللحم الأمر الذي يؤدي لزيادة نسبة المكونات الأخرى
٢- الفقد في المواد الآزوتية البسيطة خلال عملية السلق كانت أخفض بشكل معنوي في اللحم المملح.
٣- التمليح يسبب خفض نسبة الفقد خلال عملية السلق.
٤- تمليح اللح قبل عملية السلق يزيد من قبوله لدى المستهلكين.
٥- قدرة اللحم المملح على ربط الماء أعلى منه في اللحم غير المملح

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Effect of some natural products on productivity and some pests of cabbage

BY

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ABSTRACT:

The study were conducted during two consecutive seasons of 2018 and 2019 in a private farm at Marsa Matrouh Governorate which located in on Egypt northwest Mediterranean coast (latitude 31^{o} 21' N, longitude 27^{o} 14' E) to evaluate the effects of Kaolin (Aluminum phyllosilicate [$Al_2Si_2O_5$ $(OH)_4$]), Bentonite (Calcium aluminosilicate [$Al_2O_3SiO_2H_2O$]), Atabouglite (Magnesium aluminosilicate [$Al_2Mg_3O_{18}Si_6$]) products as well as chloropyrophose pesticide as foliar spraying and potassium fertilizers as soil additives on cabbage growth, yield, quality and pests control. Although foliar spray treatments did not have any significant effect on growth characters, chemical insecticide treatment produced the highest average head weight and highest yield compared with other foliar spray treatments. High rate of potassium supply as 75 kg gave the best value of growth and yield as well as quality characters followed by 50 kg then 25 kg compared with control treatment which produced the lowest values. Cabbage plants treated as foliar spraying with atabouglite, kaoline formulations exhibited high

decrease of aphid population compared with bentonite application which gave the least potential towards adult of aphid insects. Also, atabouglite had a superior effect on average cumulative cotton leaf worm *Spodoptera littoralis* (Boisd) infestations of leaves and larvae followed by Kaolin. Bentonite had the lowest effect. While, chloropyrophos (chemical treatment) reduced the infestations in highly effect compared with all treatments.

Kay wards: Cabbage, Kaolin, bentonite, atabouglite, potassium application, growth and yield, cotton leaf worm and aphid .

INTRODUCTION:

White cabbage is considered the most important leafy vegetable crop in Egypt (total area for cabbage and other brassicas is about17250 ha and total production is about 525410 ton, **FAO, 2018**). It considered a rich source of vitamin C and has high fiber and calcium content which reduces the risk of colon cancer. Moreover, contains phosphorus, which is helpful in utilization of calcium and assimilation of carbohydrates and fats in human body **(Mohammadullah *et al.*, 2020)**.

The environmental problems caused by excessive use of pesticides have been the matter of concern for most researchers. The reasons for this referred to toxicity, non-biodegradable properties and the residues of pesticides in the soil, water resources pollution which in turn effect on human health **(Koul, *et al.*, 2008)**. Thus, the current global scenario firmly emphasizes the need to adopt eco-friendly agricultural practices for sustainable food production because the problems associated with the use of hazardous chemicals for crop protection, weed control and soil fertility increasing worldwide **(Abou-Hussein, 2001; Ferrari *et al.*, 2008; Gomaa, 2008)**. Natural products are promise and excellent alternative to synthetic pesticides as a means to reduce negative impacts to human health and the

environment **(Isman and Machial, 2006)**. In this respect, the encouragement of products from natural resources and even the extremely biodegradable synthetic and semisynthetic products in pest management, has been considered to constitute the umbrella of green pesticides **(Koul *et al*., 2003; Dhaliwal and Koul, 2007; Koul, 2008)**.

Kaolin (Aluminum phyllosilicate), Bentonite (Calcium aluminosilicate) are naturally occurring industrial rock, characterized by the property of absorbing water and by capacity for base exchange. But bentonite properties are significantly greater than that of kaolin **(Kutlic *et al*., 2012)**. Both of them as well as Atabulit (Magnesium aluminosilicate) considered a clay minerals which have chemical inert over a wide range of pH and a low exchangeable captain capacity (1-16 meq/100g) **(Brown *et al*., 2010)**. Recently many researchers used this clay minerals as a natural products which creates a protective mechanical barrier against plant pathogenic diseases and pests when sprayed on the plant surface as particle film **(Lamb *et al*., 2002; Liang and Liu, 2002; Reitz *et al*., 2008 and Crooks and Prentice, 2011)**. Moreover, its effect on leaf temperature and photosynthetic rate (**Gindaba and Wand**, **2007)**, increased leaf water potential and decreased stomatal conductance (**Glenn *et al*., 2010)** and consequently may decrease growth and yield of some plants when sprayed with high concentrate (**Javan *et al*., 2013)** or increase growth and yield of others when sprayed with moderate concentrates **(Mohadeseh *et al*., 2013)**. These eco-friendly material must be combine with the good agricultural practices especially mineral nutrients which plays a critical role in plant stress resistance **(Cakmak, 2005; Amtmann et al., 2008 and Romheld, and Kirkby 2012)**.

Out of all the mineral nutrients, potassium plays a particularly critical role in plant growth and metabolism, and it

contributes greatly to the survival of plants that are under various biotic and abiotic stresses **(Wang *et al*., 2013)**. Potassium is also essential for the loading and transport of the sugar produced to developing fruits and roots. Its also enhancing crop resistance to stresses including insects, pests and various diseases, as well as drought and frost and is beneficial in extending the keeping quality of crops **(Cakmak, 2005 and Srivastava *et al*., 2018)**. Moreover, potassium is one of the essential elements in the plant and one the three that is generally needs to supplied as fertilizers. It has been clearly that, plants need to high amounts of potassium for high yield with improve its quality. The application of potassium at the rate of 100 kg k_2o /ha is necessary to obtain high yield of cabbage, **(Wijewardena and Amarasiri, 1997)**, 224 kg/ha (**Cutcliffe, 1984)** or 60 kg k_2o / he. **(Khan, *et al*., 2002)**, depending on initial potassium content of the soil, where, the actual soil concentrations of this element ranging from 0.04 to 3 per cent **(Chaitanya, *et al*., 2019)** depends on the type of parent material and degree of mineral weathering **(Sparks and Huang, 1985)**. Thus, with increasing level of potassium, yield and quality parameters of cabbage increasing **(Chaitanya, *et al*., 2019)**. Supplying potassium abundantly absorbed luxuriously without affecting the cabbage-head yield, compared with nitrogen and phosphorus which reduce the cabbage-head yield when supplied abundantly **(Hara, and Sonoda a (1979)**. Although, phosphorus supply until cabbage head initiation is enough for the normal development of a cabbage-head, potassium supply is necessary at the later as well as early growth stages **(Hara and Sonoda b, 1979)**. In addition that its role on growth and yield, potassium plays important roles in enzyme activation, protein synthesis, photosynthesis, osmoregulation, stomatal movement, energy transfer, phloem transport, cation-anion balance and stress resistance **(Marschner, 2012)**, which in turn reflect on quality and pest resistance of produce. The aim

of this work was to evaluate the effect of some natural substances such as Kaoline, Bentonite and Atabouglite as foliar spray as well as soil potassium supplies on cabbage growth, yield and control of some cabbage pests.

MATERIALS AND METHODS: The study were conducted during two consecutive seasons of 2018 and 2019 in a private farm at Marsa Matrouh Governorate which located in on Egypt northwest Mediterranean coast (latitude 31^{o} 21' N, longitude 27^{o} 14' E) to evaluate the effects of Kaolin (Aluminum phyllosilicate [$Al_2Si_2O_5$ $(OH)_4$]), Bentonite (Calcium aluminosilicate [$Al_2O_3SiO_2H_2O$]), Atabouglite (Magnesium aluminosilicate [$Al_2Mg_3O_{18}Si_6$]) products as well as chloropyrophose pesticide as foliar spraying and Potassium fertilizers as soil additives on cabbage growth, yield and quality. Two factors were tested, the first included five foliar treatments, control (tap water), kaolin at concentration of 2%, bentonite at 2 % and atabouglite at 2% and chloropyrophose at 2 cm /liter. While the second factor included, potassium sulfate at 150, 100 and 50 kg /fed as well as control (without addition). Traditional agricultural practices of cabbage baladi cv. has done. Recommended dose of mineral fertilizers (90 and 60) units of N and P during growing seasons were added. the experimental plot contain one line 1 m width and 10.5 m length and every plot contain 17 plants. The foliar spraying was applied after 20 days from transplanting and repeated every 20 days (four times) while fertilizer amounts were applied at the same time as 20%, 20%, 30% and 30% of treatment weight.

Data Recorded/Growth Characters:

After 60 days from transplanting, five plants were randomly taken from each experimental plot to record growth characters *i.e.* plant height, leaves number, fresh and dry weight (g) of plant.

Yield and its component:

At harvest (90 days after transplanting), cabbage plants which formed marketable heads were counted, weighted then, diameter and compactness index were measured. Early yield was determined then other characters weakly repeated fourth.

Chemical component:

potassium content and dry matter percent were determined in leaves according to **AOAC (1990)**.

Insect observations: Samplings of cabbage leaves with three replicates were arranged in a split plot design. Samples of 25 leaves from each replicate representing different levels and directions of the plants were randomly collected to investigate cabbage insects that attacking plants **(Sharaby *et al.* 2015)**. For all treatments, samples of infested leaves were collected immediately before spraying as index of pre – treatment count, and every 20 days after the successive sprays to determine the level of infestation. The collected samples were kept in paper bags in a refrigerator till examined by the use of a binocular microscope. They were separated, identified and counted. The percentage of reduction in infestation was calculated according to the formula **(Topps and Wain, 1957)**.

$$R\,\% = \frac{C - T}{C} X\,100$$

Where:

C: Number of insects recorded in the control samples.

T: Number of insects recorded in treatment samples.

Experimental design and statistical analysis:

Split plot design with three replicates was used, where, foliar spray treatments were placed in main plot, while potassium application treatments occupied sub-plots. Data were subjected to statistical analysis according to **Thomas and Hills (1975)**. The differences among means were performed using least significant difference (LSD) at 5% level.

RESULTS AND DISCUSSION:

Growth characters: The effect of natural products foliar spray treatments, potassium supply and interaction between them on plant height, leaves number and plant fresh weight are shown in table (1). All foliar spray treatments did not have any significant effect on growth characters, except plant height in the first season, where, insecticide treatment produced the highest plants compared with other treatments. Both insecticide and control treatments had a slight increasing of plant fresh weight compared with other treatments, but this increasing was not significant in both seasons. On the contrary, control treatment (without potassium supply) compared with other potassium treatments produced the lowest values of plant height, leaves number and plant fresh weight in both seasons. In this respect, high rate of potassium supply as 75 50 kg gave the best value followed by 50 kg then 25 kg. Regarding interaction effects, all interaction effects were significant in both seasons. The most pronounced effect was increasing plant height and plant fresh weight when cabbage plants treated with high concentrates of potassium with pesticide or control treatments compared with without potassium treatment with all foliar spray treatments in both seasons. Relatively decreasing of growth when natural products used may be due to that, used of clay minerals as a natural products which creates a protective mechanical barrier when sprayed on the plant surface as particle film have strongly effect on leaf temperature and photosynthetic rate **Gindaba and Wand (2007)**, increased leaf water potential and decreased stomatal conductance **Glenn *et al*., (2010)** and consequently may decrease growth and yield plants **Javan *et al.*, (2013).** On the other hand increasing growth characters with increasing potassium supply was expected and agree with **(Wijewardena**

and Amarasiri, 1997; Cutcliffe, 1984; Khan, *et al.*, 2002 and Chaitanya, *et al.*, 2019).

yield and its component:

Data presented in table (2) showed that, number of marketable heads, average head weight and total yield per plot significantly affected by foliar spray treatments, potassium supply and interaction between them in both seasons. Insecticide treatment produced the highest number of marketable heads and total yield per plot followed by kaolin treatment then other natural products, while, foliar spay control treatment gave the lowest number of marketable heads and lowest total yield per plot in both seasons. Also, insecticide treatment gave the highest average head weight compared with other foliar spray treatments in both seasons. Concerning potassium supply treatments, both 75 and 50 kg gave the highest value of marketable heads number, average head weight and total yield followed by 25 kg treatment compared with control (without potassium supply) which gave the lowest value in this respect in both seasons. Moreover, high potassium rates 75 and 50 kg with insecticide foliar spray treatment gave the highest values compared with control and 25kg of potassium especially with atapolite and bentonite foliar spray treatments.

The superiority of natural products on yield may be attributes for its effect on cabbage pest control which consequently reflected on number of marketable units per plot and total yield. many researchers reported that, clay minerals creates a protective mechanical barrier against plant pathogenic diseases and pests when sprayed on the plant surface as particle film **(Lamb *et al.*, 2002; Liang and Liu, 2002; Reitz *et al.*, 2008 and Crooks and Prentice, 2011)**. These eco-friendly material must be combine with the good agricultural practices especially mineral nutrients which plays a critical role in plant stress resistance **(Cakmak, 2005; Amtmann *et al.*, 2008 and Romheld, and Kirkby 2012)**.

Table (1): Effect of natural products foliar spray and potassium supply on plant height, leaves number and plant fresh weight sixty days after transplanting

Characters		Plant height (cm)		Leaves no.		Plant F.w.(g)	
Seasons		1 st	2nd	1 st	2nd	1 st	2nd
Foliar spray							
Atabouglite		42.49	44.65	17.08	17.99	817.4	826.7
Bentonite		42.26	45.05	17.23	18.14	816.2	807.1
Kaolin		42.19	45.39	17.09	18.13	807.2	816.2
Insecticide		46.29	46.29	17.11	18.18	838.0	828.4
Control		42.95	46.29	17.01	18.13	838.8	863.3
LSD at 0.05		1.04	N.S	N.S	N.S	N.S	N.S
Potassium							
75 kg k_2o		45.60	48.41	18.36	19.24	840.4	852.0
50 kg k_2o		45.20	46.99	18.35	18.80	844.0	841.6
25 kg k_2o		43.42	46.31	17.04	18.74	848.9	849.3
Control		38.73	40.43	14.67	15.68	760.9	770.4
LSD at 0.05		0.78	1.02	0.39	0.41	22.4	21.1
Interaction							
Atabouglite	75 kg k_2o	45.66	47.36	18.26	19.24	832.3	846.3
	50 kg k_2o	44.35	46.00	18.30	18.81	821.1	839.3
	25 kg k_2o	43.43	45.94	17.12	18.60	853.9	865.1
	Control	36.53	39.28	14.65	15.31	762.4	756.0
Bentonite	75 kg k_2o	45.23	47.36	18.76	19.00	829.9	832.3
	50 kg k_2o	44.97	46.69	18.54	18.68	832.5	831.2
	25 kg k_2o	42.08	45.94	16.96	19.07	845.2	831.8
	Control	36.77	40.22	14.65	15.81	757.1	733.1

Kaolin	**75 kg k_2o**	45.23	48.71	18.39	19.34	825.5	848.8
	50 kg k_2o	44.96	46.73	18.62	18.72	822.1	832.6
	25 kg k_2o	42.08	45.94	16.70	18.66	820.6	815.9
	Control	36.49	40.19	14.65	15.81	760.8	767.5
Insecticide	**75 kg k_2o**	45.64	48.93	18.26	19.31	856.7	849.6
	50 kg k_2o	45.93	47.50	18.12	19.13	888.8	865.9
	25 kg k_2o	46.54	47.09	17.06	18.69	837.5	835.8
	Control	47.05	41.63	15.02	15.61	769.1	762.5
Control	**75 kg k_2o**	46.24	49.69	18.11	19.24	857.5	882.9
	50 kg k_2o	45.78	48.00	18.19	18.80	855.4	839.2
	25 kg k_2o	42.96	46.61	17.34	18.74	887.3	898.0
	Control	36.83	40.85	14.40	15.68	755.1	832.9
LSD at 0.05		**1.75**	**2.28**	**0.87**	**0.92**	**50.1**	**47.1**

Moreover, potassium supply enhanced cabbage growth and yield. This referred to its important roles in enzyme activation, protein synthesis, photosynthesis, osmoregulation, stomatal movement, energy transfer, phloem transport, cation-anion balance and stress resistance **(Marschner,2012)**, which in turn reflect on quality and pest resistance of produce. So, the application of potassium produced high yield of cabbage, **(Wijewardena and Amarasiri, 1997; Cutcliffe, 1984; Khan, *et al.*, 2002). (Chaitanya, *et al*., 2019)**.

Table (2): Effect of natural products foliar spray and potassium supply on number of marketable heads, average head weight and total yield per plot

Characters		No. of marketable heads		Average head weight (g)		Total yield /plot (kg)	
Seasons		1 st	2nd	1 st	2nd	1 st	2nd
Foliar spray							
Atabouglite		14.50	13.33	4035	4208	58.65	56.17
Bentonite		14.58	13.25	4010	4171	58.50	55.39
Kaolin		15.00	14.00	4030	4214	60.55	59.14
Insecticide		16.08	16.08	4146	4347	67.03	70.11
Control		13.58	12.75	4019	4137	54.75	52.84
LSD at 0.05		**0.97**	**0.77**	**80**	**85**	**4.56**	**3.62**
Potassium							
75 kg k_2o		15.20	14.60	4175	4290	57.31	62.72
50 kg k_2o		15.24	14.60	4225	4332	60.81	63.36
25 kg k_2o		15.33	14.53	4032	4199	57.45	61.10
Control		13.27	11.80	3760	4040	43.43	47.73
LSD at 0.05		**0.52**	**0.47**	54	61	2.43	2.04
Interaction							
Atabouglite	**75 kg k_2o**	15.00	14.00	4139	4216	62.11	59.00
	50 kg k_2o	14.67	13.67	4187	4293	61.44	58.64
	25 kg k_2o	15.00	14.33	4034	4214	60.60	60.42
	Control	13.33	11.33	3780	4111	50.46	46.62
Bentonite	**75 kg k_2o**	14.67	14.33	4133	4284	60.64	61.39
	50 kg k_2o	14.33	14.00	4221	4231	60.50	59.24
	25 kg k_2o	15.33	13.33	3932	4168	60.31	55.59

	Control	14.00	11.33	3753	3999	52.54	45.35
Kaolin	**75 kg k_2o**	15.33	14.33	4154	4299	63.72	61.60
	50 kg k_2o	15.67	15.00	4203	4362	65.86	65.42
	25 kg k_2o	15.00	15.00	3998	4183	59.97	62.69
	Control	14.00	11.67	3765	4013	52.65	46.84
Insecticide	**75 kg k_2o**	17.67	17.33	4255	4425	73.77	76.69
	50 kg k_2o	17.00	17.33	4274	4488	72.66	76.30
	25 kg k_2o	16.33	16.67	4278	4334	71.32	72.25
	Control	13.67	13.33	3778	4140	50.36	55.21
Control	**75 kg k_2o**	13.33	13.00	4194	4225	57.31	54.93
	50 kg k_2o	14.00	13.33	4242	4288	60.81	57.21
	25 kg k_2o	14.00	13.33	3917	4096	57.45	54.56
	Control	13.33	11.33	3724	3940	43.43	44.65
LSD at 0.05		**1.17**	**1.05**	**120**	**137**	**5.44**	**4.55**

Quality characters:

The effect of natural products foliar spray, potassium supply treatments and their interactions on compactness index, dry matter percent and potassium content were shown in table (3) . foliar spray treatments had not significant effects on this characters, except dry matter percent and potassium content in first season, where, insecticide and control treatments increased both characters compared with other foliar spray treatments. Regarding potassium supply treatments effect, high rates 75 and 50kg gave the highest value of compactness index followed by

25 kg treatment, while control of potassium treatments gave the lowest value. All potassium treatments gave the highest dry matter percent and potassium content compared with control which gave the lowest values in both seasons. Moreover, interaction effects were significant on compactness index, dry matter percent and potassium content. High potassium rates with insecticide foliar spray treatment gave the highest values, while without potassium treatment (control) with all foliar spray treatments gave the lowest values in both seasons. Increasing of compactness index because, potassium supply improved average head weight, while the average head diameter was relatively constant which reflected on compactness value. Also, dry matter and potassium content increasing with increasing of potassium supply which in turn enhancement head cabbage quality and resistance for pests. Similar results were found by **(Hara and Sonoda a (1979); Cakmak, 2005; Amtmann *et al*., 2008 and Romheld, and Kirkby, 2012 and Marschner, 2012)**.

Table (3): Effect of natural products foliar spray and potassium supply on compactness index, dry matter percent and potassium content

Characters	Compactness index		Dry matter %		Leaves potassium content	
Seasons	**1 st**	**2nd**	**1 st**	**2nd**	**1 st**	**2nd**
Foliar spray						
Atabouglite	121.6	127.5	12.20	12.71	3.17	3.42
Bentonite	122.7	126.5	12.16	12.75	3.18	3.41
Kaolin	121.8	124.8	12.12	12.72	3.26	3.44
Insecticide	125.4	128.2	12.83	13.21	3.39	3.52
Control	118.3	125.4	12.95	13.01	3.33	3.45
LSD at 0.05	**N.S**	**N.S**	**0.23**	**N.S**	**0.11**	**N.S**
Potassium						
75 kg k_2o	129.4	133.3	12.84	13.37	3.50	3.61

50 kg k_2o		127.4	132.0	12.77	13.33	3.47	3.56
25 kg k_2o		121.9	126.2	12.82	13.29	3.37	3.60
Control		109.1	114.4	11.37	11.54	2.72	3.02
LSD at 0.05		**2.7**	**2.7**	**0.17**	**0.22**	**0.08**	**0.11**
Interaction							
Atabouglite	**75 kg k_2o**	125.9	131.8	12.63	13.43	3.41	3.57
	50 kg k_2o	130.2	130.4	12.35	12.93	3.34	3.56
	25 kg k_2o	122.9	132.9	12.37	13.05	3.18	3.54
	Control	107.5	114.8	11.44	11.44	2.76	3.00
Bentonite	**75 kg k_2o**	128.4	132.9	12.41	13.37	3.36	3.53
	50 kg k_2o	131.2	132.8	12.32	13.15	3.46	3.51
	25 kg k_2o	124.8	126.0	12.66	13.14	3.26	3.57
	Control	106.5	114.6	11.26	11.34	2.65	3.03
Kaolin	**75 kg k_2o**	132.5	132.7	12.48	13.07	3.56	3.56
	50 kg k_2o	126.1	131.0	12.41	13.41	3.42	3.62
	25 kg k_2o	120.7	122.8	12.32	13.21	3.38	3.67
	Control	108.2	112.6	11.29	11.17	2.66	2.90
Insecticide	**75 kg k_2o**	133.8	135.3	13.42	13.60	3.65	3.82
	50 kg k_2o	125.9	136.2	13.32	13.69	3.61	3.69
	25 kg k_2o	122.9	125.2	13.30	13.73	3.56	3.59
	Control	119.1	116.3	11.27	11.84	2.73	2.99
Control	**75 kg k_2o**	126.6	133.6	13.28	13.38	3.53	3.56

50 kg k_2o	123.8	129.8	13.45	13.48	3.54	3.44
25 kg k_2o	118.4	124.1	13.45	13.29	3.49	3.61
Control	104.4	114.0	11.61	11.54	2.77	3.17
LSD at 0.05	**6.1**	**6.0**	**0.38**	**0.49**	**0.18**	**0.25**

Effect of ataboglite, kaolin and bentonite against some cabbage pests:

1.Treatments on cotton leaf worm *Spodoptera littoralis* (Boisd).

The obtained data in Table (4) indicated that infestation was significantly lower in the treated plants than untreated ones. The results in Table (4) cleared that the atabouglite was the superior effect on average cumulative cotton leaf worm *Spodoptera littoralis* (Boisd) infestations of leaves and larvae. Kaolin was the second potential effect after atabouglite . Bentonite was lowest effect . These results agreed with **Ali (2016)** who found that kaolin and bentonite product in different concentrations suppressed olive fruit fly infestations. Particle film technology has emerged as a new method for controlling arthropod pests and diseases of agricultural crops **Glenn *et al*. (1999)**.

Table (4): Effect of foliar treatments on cotton leaf worm *Spodoptera littoralis* (Boisd) on cabbage

Foliar Treatments	Infestations			
	Leaves		Larvae	
	Mean	R%	Mean	R%
Control	8.3		9.6	
Atabouglite	2.4	71.1%	1.9	80.2%
Kaoline	2.8	66.3%	2.7	71.8%
Bentonite	5.2	37.3%	5.7	40.6%
Chloropyrophose	0.2	97.5	0.1	99.0

R % = Reduction percentage

2- Effect of foliar spraying on aphid (*Aphis crassivora*)

The data illustrated in table (5) presented that, the foliar spraying revealed significantly lower infestation of aphid insects in the treated plants than untreated ones. The evaluation of aphid infestation on cabbage plants implemented prior to natural products atabouglite, kaoline and bentonite treatments which gave acceptance effects against adults of aphid population on the final results across the treatments. The cabbage plants treated as foliar spraying with atabouglite, kaoline formulations exhibited high decrease of aphid population that was statistically similar to the infestation prior to the treatment that produced the greatest reduction in the leaves and adult infestations. The bentonite application was the least potential towards adult of aphid insects. The chloropyrophos reduced the infestations in highly effect. On the other hand, the untreated control recorded higher infestations of mealy bug insects. These results were in agreement with those obtained by **Marko *et al*. (2008),** who mentioned that kaolin treatment reduced the population density of *Aphis pomi*, *Anthonomus pomorum*, and *Empoasca vitis*, and the number of communal caterpillar webs. Also the results can be similar with **Soubeih *et al*. (2017)** cleared that and kaolin as foliar spraying were the superior effect at 5% concentration on cumulative leafminer, aphid infestations and early blight disease incidence and severity.

Table (5): Effect of foliar spraying on aphid (*Aphis crassivora*) on Cabbage

Foliar Treatments	Infestations			
	Leaves		Adult	
	Mean	R%	Mean	R%
Control	12.5		15.4	
Atabouglite	1.8	85.6%	1.8	88.3
Kaoline	2.4	80.8%	2.3	84.1%
Bentonite	6.5	48.0%	6.3	59.0%

Chloropyrophose	0.3	97.6	0.1	99.4

R % = Reduction percentage

CONCLUSION:

Potassium application as soil fertilizers at 75 or 50 kg k_2o enhanced cabbage growth, increased number of marketable heads and consequently increased cabbage yield. Also, using natural clay compounds as alternative of chemical treatments increased number of marketable heads and increased cabbage yield compared with control. Spraying with atabouglite, kaoline formulations exhibited high decrease of aphid and cotton leaf worm population compared with bentonite application which gave the least potential. While, chloropyrophos (chemical treatment) reduced the infestations in highly effect compared with all treatments.

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Effect of Soil Solarization and Bio-fertilization on Strawberry Production and pathogenic Fungi under Siwa Oases Conditions

BY

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Abstract:

The present study was carried out during the two successive seasons of 2017-2018 and 2018-2019 in the experimental station, desert research center at Siwa oasis, Marsa Matrouh Governorate to evaluate the effect of soil solarization and bio-fertilization on soil borne microorganisms, weed characters, growth, yield and quality of strawberry. The experiment included two solarization treatments (solarize and non-solarize) and five bio-fertilizers treatments (Bio-fertilizers alone, bio-fertilizers + 0.25 mineral fertilizers, bio-fertilizers + 0.5 mineral fertilizers, bio-fertilizers + 0.75 mineral fertilizers as well as the traditional treatment as a control. The results indicated that, soil solarization increased average soil temperature and eradicated most annual broad and narrow-leaved weeds, increased microorganisms population and reduced rotted fruit caused by pythium or phytophthora as well as increasing of strawberry growth early yield and yield. Traditional treatment produced the highest yield followed by bio-fertilizers treatments with 0.75, 0.50 and 0.25 percent of chemical fertilizers compared with bio-fertilzers alone. On the other hand, bio- fertilizers produced the highest fruit quality and gave the lowest values of rotted fruits.

Kay wards: Solarization, bio-fertilization, pathogen fungi, total bacteria, pythium and phytophthora.

INTRODUCTION

Strawberry (*Fragaria x ananassa* Duch.) has been widely cultivated in Egypt. It is one of the most important vegetable crops for local consumption and exportation (planted area is about 11072 hectar and total production about 407240 Ton, **FAO, 2017**). Cultivated area in Egypt has been increasing in recent years especially due to the mediterranean climate, fertile soils, and geographic location which support high production, early and profitability of such a specialty crop **(Abd-Elgawad, 2019)**.

Soil-borne diseases cause heavy losses to strawberry production *i.e. Macrophomina phaseolina* and *Fusarium spp*. (**Benlioglu *et al.* 2014)**, *Phytophthora cactorum* , *P. citricola* and *Verticillium dahlia* **(Hartz *et al.*, 1993**), *Pythium and Rhizoctonia*, **(Camprubi *et al.*,2007)**. Also, **Embaby, 2007; Khafagi, 1982; Tadrous, 1991** and **Tarek, 2004** under Egyptian conditions found that, *Alternaria spp., Aspergillus spp., Botrytis cinerea, Rhizopus stolonifer, Rhizoctonia solani, Phytophthora cactorum, Fusarium spp., Penicillium spp.* And *Sclerotinia sclerotiorum* are the most fungal isolates causing strawberry fruit rots.

Soil solarization is a nonchemical soil disinfestation method which harnesses solar energy for heating the soil. It involves hydro-chemical processes leading to physical, chemical and biological changes in the soil, which take place during and even after the termination of solarization, **Katan (1998)**. Solarization is a potential alternative practice for soil fumigation which has been phased out due to its environmental risks, where, solarization controlled a wide range of fungal pathogens and weed pests **(Himelrick and Dozier, 1991; Katan, 1981; Katan and DeVay, 1991; Pullman *et al*., 1981; Stapleton and DeVay, 1986 and Gomaa, 2008)**. In this respect, **De vay (1991)** reported that, solarization commonly targets mesophyllic organisms, which include most plant pathogens and pests, without destroyed

the beneficial mycorrhizal fungi and the growth promoting (*Bacillus spp*.). So, the lethal effects are most pronounced on microorganisms which have not good soil competitors and many plant pathogens fall in to this group, since they tend to have specialized physiological requirements which are more adapted to co-existence with the host plant **(Stapleton, 1991)**. Soil solarization is an effective soil disinfestation technique for most vegetable crops **(Candido *et al.*,2008)**, especially strawberry production **(Hartz *et al*., 1993; Camprubi *et al*., 2007 and Domínguez *et al*., 2014).**

In the last twenty years, ecological farms have been used environmentally friendly agricultural practices to improve plants yield and fruit quality. A real challenge in ecological fruit production and agricultural sustainability is the reduction of chemical fertilization and chemical treatments for pests and disease control. In this direction, scientists actively search for good agricultural practices and compounds of natural origin that are natural adaptors and do not disturb plants ecological balance **(Vasil'eva *et al*., 2005, Caulet *et al*., 2013 and Gomaa, *et al*., 2016).**

Bio-fertilization has been widely used, especially with vegetable crops vs lettuce **(El Massiry, 2009)**, globe artichoke **(Ibrahim, 2009)**, Jerusalem artichoke **(Hafez, 2013)** and thyme **(Attia *et al*., 2006)** and strawberry **(El-Miniawy *et al*., 2014** and **Gomaa *et al*., 2016)**. On potato**, Gomaa, (2008)** found that organic and bio-fertilization improve yield and enhance the efficacy of solarization and unfortunately beneficial microorganisms (bio-fertilizers) which needed to add after solrization.

It could be a particularly attractive practice for strawberry production in Siwa oasis area which located in the northern part of the western desert of Egypt, where's strawberry crop is grown

as an annual, with a very warm summer fallow period (ideal conditions for solarization) followed by a fall planting through October and November. So, this study was undertaken to document the ability of soil solarization to control annual weeds and soil borne pathogens and its effect on productivity of strawberry plants treated with bio-fertilizers in the warmer planting area of Egypt.

MATERIALS AND METHODS

The present study was carried out during the two successive seasons of 2017-2018 and 2018-2019 in the experimental station, desert research center at Siwa oasis, Marsa Matrouh Governorate to evaluate the effect of soil solarization and bio-fertilization on soil borne microorganisms, weed characters, growth, yield and quality of strawberry.

Experimental design:

During July, soil experiment was ploughed and divided into rows, each one have 1.m width and 10.5m length. Organic fertilizers, rock phosphate and rock potassium (Felsibar) were applied for all plots except the traditional treatment plots (control) where contain organic fertilizers, calcium super phosphate, ammonium sulphate and potassium sulphate as recommended, then fertilizers were incorporated in rows and levelled before trickle irrigation lines were installed.

Soil experiment irrigated abundantly then the trickle lines were removed and soil covered with clear poly ethylene traps of 60 micron thickness for about 6 weeks during August and September, while an untreated soil was used as a control. Soil temperatures were measured weekly during 6 weeks of solarization, then the polyethylene traps were removed and directly soil samples has taken from 0-15 cm depth to determine the densities of microorganisms (total counts of bacteria, fungi, and pathogen fungi). Fresh strawberry transplants cv. Festival

were hand transplanted in 4 rows and 30 cm apart on the med. of October in two seasons, then bio-fertilizers which purchased from the general authority of agricultural funds and equalization, namely Biogen (a symbiotic nitrogen fixing bacteria), Phosphorin (phosphate solubilizing bacteria) and Potassumage (potassium solubilizing bacteria) were applied directly after transplanting and monthly during growth stages for all experiment except the traditional treatment plots.

The experimental design was split plot with 5 replicates. The plot area was 10.5 m^2 included 140 plants. Soil solarization was assessed in main plot while bio-fertilizers were assessed in sub plot. The experiment includes 10 treatments which were the combination between two solarization treatments (solarize and non-solarize) and five bio-fertilizers treatments (Bio-fertilizers alone, bio-fertilizers + 0.25 mineral fertilizers, bio-fertilizers +0.5 mineral fertilizers, bio- fertilizers + 0.75 mineral fertilizers as well as the traditional treatment as a control. The traditional treatment plots received 300 kg calcium super phosphate (15.5 % P_2O_5) applied during soil preparation then 300 kg ammonium nitrate (33.5 %), 50 kg phosphoric acid (85% P_2O_5) and 250 kg potassium sulfate (48.5 % K_2O) / feddan were divided into 10 equal parts and applied weekly through fertigation system during the growing season starting fifteen days transplanting later. Fertigation occurred four times every week and the bio treatments bio 4 (0.75%) , bio 3 (50%), bio 2 (0.25%) received the fertigation 3, 2, and 1 time every week respectively as well as no received for bio 1.

Soil temperature: during solarization period, soil temperatures at 0, 5, 10 and 15cm were recorded weekly during day hours at 8 am to 8 pm.

Soil microorganisms: soil samples were taken before and after solarization to determine total microbial counts using nutrient

agar medium, PDA-Rose Bengal medium and PDA-PCNB medium to culture bacteria, total fungi and pathogen fungi, respectively. Samples were examined for total fungi and pathogen fungi using the dilution method **(Talyour, 1962)** and Plate count technique **(Johnson *et al*., 1959)**. Martine medium **Martine (1950)** and **Nash** and **Synder (1962)** were used to determine fungi and pathogen fungi respectively. Total bacteria was determined by using method of **Holt *et al*., (1994)**.

Weed measurements: during the second season broad and narrow-leaved were taken from a randomly quadratic meter after 4 and 8 weeks from transplanting to determine average number and total fresh weight.

Growth characters: Two weeks after transplanting, strawberry plants per plot were counted then survival ration were calculated. Six weeks after transplanting, randomly samples of 5 plants from each plot were taken to determine shoot high, shoot fresh weight and leaves number per plant.

Yield components: Strawberry fruits were harvested two times weekly during the growing seasons, counted, and weighed to calculate average fruit number and weight. The early yield per plant was determined as weights of all harvested fruits during the first five harvesting times. Total yield per plant was calculated.

Fruit quality: Twenty five fruits were randomly collected from each treatment in the middle of the growing seasons and fruit firmness was measured using Shatillon penetrometer. Soluble solid content (SSC) was determined by using digital refractometer (Abbe Leica model) and L ascorbic acid content was determined according to the methods described by **A.O.A.C. (2005)**.

Disease incidence Disease incidence was assessed as a total number of rotted fruits as compared with total fruits number from beginning to the end of harvesting time in all treatments.

The diseases of fruits were separated according to different symptoms: gray mold (*Botrytis cinerea*) and dry rot (*Rhizoctonia solani*). Number of fruits in each group were counted and total fruit rot numbers was counted, then the lost yield was calculated.

Statistical analysis: Data were subjected to statistical analysis by M-STAT C **(Russell, 1991)**. The differences among means were performed using least significant difference (LSD) at 5% level.

RESULTS AND SISCUSSION

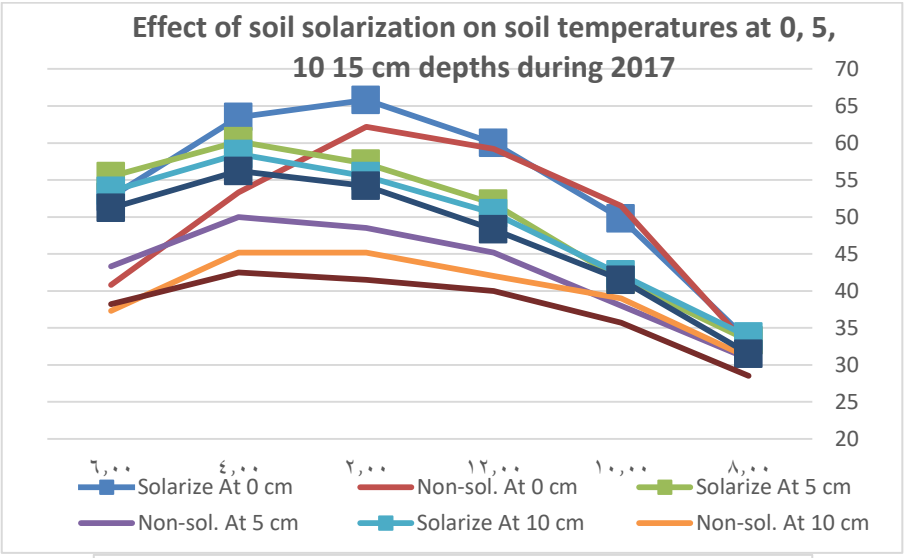
Soil temperatures: Temperature reading daily recorded every two hours at day time (8 am to 6 pm) ones every week during solarization period at four depths 0, 5, 10, and 15 cm (Fig 1). An increasing in the temperature of solarized soil was observed up to a maximum of 63.8 and 60.2 c^o at 2 pm for soil surface compared to 60.2 and 56.6 c^o for non-solarized soil surface in first and second seasons respectively. High temperatures at 5 cm depth were 57.2 and 55.8 at 4 pm in solarized plots compared with 49.0 and 49.2 for non-solarized at the same time and depth in two seasons respectively. At 10 and 15 cm depths solarized soil plots recorded (55.5, 54.2) and (52.4, 50.4) at 4 pm in the first and second season, while temperatures in non-solarize treatment recorded (44.2, 41.5) and (41.2, 40.0 c^o for first and second season respectively. From the previous data, it was clearly that, covering soil with transparent plastic traps raised the average absolute soil temperatures at the four depths with an increment values (3.6, 8.2, 11.3 and 11.2 c^o) and (3.6, 6.6, 12.7 and 10.4) compared with bare soil in the first and second seasons respectively. Although maximum soil temperature decreased with increasing soil depth at all, the deferent between solarize treatments increased with increasing soil depth (Fig. 1). These results are similar with results obtained by other investigators

(Bicici *et al*.,2000; Campiglia *et al.*,2000; Shukla *et al*., 2000; Peachey *et al*., 2001; Rieger *et al*.,2001).

Soil microorganisms: Data presented in Table (1) showed, total fungi, total bacteria and pathogen fungi before and justly after solarization treatment. Population of microbes at 15 cm of soil depth drastically reduced with solarize treatments compared with non-solarize. The reduction percentages were 72.37, 87.08 and 92.66 percent for total fungi, total bacteria and pathogen fungi respectively. **Similar results were found by Triki *et al*., (2001); Hamada, (2002); El-Sheshtawy (2006) and Gomaa, (2008).**

Regarding bio-fertilization effect and development of total fungi, total bacteria and pathogen fungi counts throughout planting season, data presented in table (2) showed that, population of all microorganisms was relatively higher at end of season (April) compared with it at transplanting (October). Also, its counts with non-solarize treatment was higher than solarize. The most pronounced effect was pathogen fungi count, which increased on April compared with October and drastically decreased with solarization compared with non-solarization. Total count of bacteria sharply increased with solarization on April samples compared with October samples. It may be worth to mention that**,** most increment of bacteria population with solarization belonged to bio-fertilizers supplied which considered a beneficial organisms. From the previous data, we notice that, decreasing of soil microorganisms after solarization may be due to chemical and microbial activities, which led to generation of toxic compounds in vapor and liquid phases and consequently accumulate under plastic mulch especially near soil surface which in turn become more effective against soil flora **(Gamliel *et al*., 2000)**. The effect of solarization was most pronounced on mesophyllic group which include most plant pathogens and pests **(Abu-Gharbieh, 1998)**. While most beneficial organisms

belonged to thermophyllic group which can be survive and even flourish under solarization **(De Vay and Stapleton 1998)**.



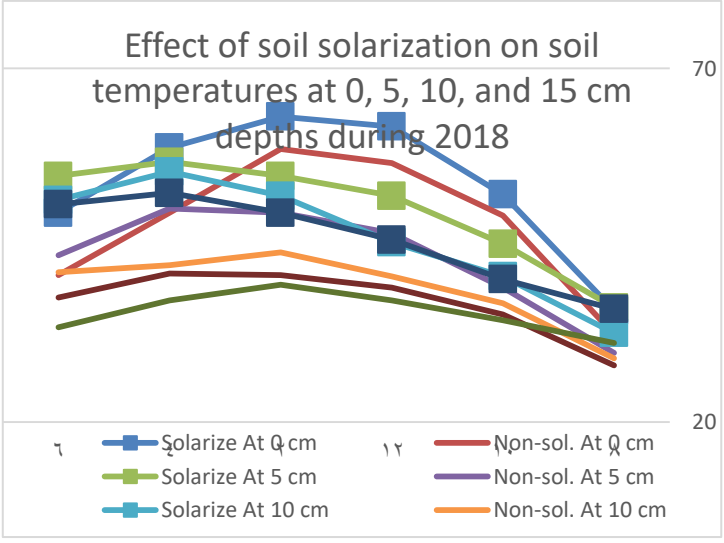


Figure (1) Effect of solarization on soil temperatures at soil surface, 5 cm, 10 cm and 15 cm depth during 2017 and 2018 seasons.

Table (1): Effect of soil solarization on total count of fungi, bacteria and pathogen fungi (CFU/ g dry) pre and post solarization treatment (on July and September) at 15 cm depth.

		Total Fungi (10^4)	Total Bacteria (10^6)	Pathogen Fungi (10^4)
Solarize	Before (July)	188.35	٣٢٥,٨٦	**12.64**
	After (September	٥٤,٥٢	٤٤,٢٥	١,٣٧
Non-Solarize	Before (July)	١٨٤,٦٥	٣٣١,٣٤	١٢,٣٨
	After (September	١٩٧,٣١	٣٤٢,٣٦	١٨,٦٧

Table (2): Effect of soil solarization, bio-fertilization and interaction on total count of fungi, bacteria and pathogen fungi (CFU, g dry) on October and April.

		October (at transplanting)			April (end of season)		
Solarization		Total fungi (10^4)	Total bacteria (10^6)	Pathogen fungi (10^4)	Total fungi (10^4)	Total bacteria (10^6)	Pathogen fungi (10^4)
Solarize	Bio 1	53.5	43.18	1.61	47.5	268.22	4.36
	Bio 2	48.3	44.42	1.64	45.5	261.15	3.38
	Bio 3	47.5	44.51	2.11	44.3	255.57	3.68
	Bio 4	46.3	46.41	1.34	46.6	214.38	3.92
	Bio 5	45.7	45.13	1.67	52.4	86.47	6.18
Non-Solarize	Bio 1	188.3	327.41	16.41	174.5	338.14	22.14
	Bio 2	185.4	335.18	14.32	177.3	347.65	24.35

	Bio 3	178.3	312.08	16.42	178.6	365.15	24.22
	Bio 4	185.6	314.21	17.17	178.6	344.81	22.35
	Bio 5	188.4	315.42	16.54	214.5	317.45	26.15
L.S.D at 0.05 for solarization		15.1	16.2	1.62	5.11	44.46	1.23
L.S.D at 0.05 for fertilization		N.S	N.S	N.S	3.27	16.81	1.34
L.S.D at 0.05 for interaction		N.S	N.S	N.S	4.62	23.77	N.S

Weeds control: The effect of soil solarization, bio-fertilization and their interaction on broad and narrow leaved numbers and fresh weight after four and eight weeks during 2017 growing season are presented in Table (3). Solarization significantly decreased broad-leaved and narrow-leaved numbers and fresh weight compared with non-solarize treatment. On other hand, fertilization treatment and interaction did not have significant effect except broad and narrow-leaved fresh weight after eight weeks from transplanting. Conventional fertilizer treatment produced heaviest, followed by bio 4, bio 3 and bio 2 treatments for broad-leaved or bio 4 and bio 3 for narrow-leaved as compared with bio 1 or bio 1 and bio 2 for broad and narrow-leaved respectively. Concerning interaction effect, conventional fertilizer treatment with non-solarize produced the heaviest broad and narrow-leaved fresh weight after eight weeks compared with other treatments. The most pronounced decreased weeds weight obtained when soil solarized with all fertilizer treatments or with bio 1 and bio 2 for broad and narrow-leaved respectively. Our results indicated that, soil solarization with clear poly ethylene has strong effect on weed germination, as well as fresh weight of broad and narrow-leaved weed after four and eight weeks (Table 3). The reducing of weed number and weight attributed to raising the temperature of soil to lethal levels for weed seed germination **(De Vay and stapleton, 1998)** or

attributed to chemical, physical and biological changes which caused in the soil that provide effective management of weed control **(Abu-Gharbieh, 1998).** Moreover, we noticed that, increasing narrow- leaved weed numbers compared with broad-leaved after four and eight weeks as well as increasing number and weight of total weeds in general after eight weeks compared with four weeks. These results may be due to that, narrow-leaved seed weed is more tolerant and adapted to lethal effect of high temperature and relatively removing solarisation effect after eight weeks as compared with four weeks. Similar results were obtained by **(Hamada, 2002 and El-Sheshtawy, 20006)**.

Table: (3) Effect of soil solarization and bio-fertilization on number and fresh weight of broad-leaved and narrow-leaved at 4 and 8 weeks after transplanting, 2018 season).

Characters	Broad-leaved weeds No		Narrow-leaved weeds No		Broad-leaved weeds fresh weight		Narrow-leaved weeds fresh weight	
Seasons	4 weeks	8 weeks	4 weeks	8 weeks	4 weeks	8 weeks	4 weeks	8 weeks
Solarization								
Solarize	1.80	٤,٧٢	٤,٢٦	٧,٤٣	١١٧,٠٩	٢٢١,٨٤	٤٦,٨٤	١١٢,٠٩
Non-solarize	13.02	٣٩,١٠	٤١,٣٠	٦٩,٩١	٥٧٢,٦٧	١٦٩٨,٧٢	٣٧١,٦٩	١٠٤٦,١٠
LSD at 0.05	**1.20**	١٠,١	٣,٢٦	٨,٣٧	٤٥,٢٣	٣٩٢,٢٠	٨٣,٤٣	٩٩,٢١
Bio-fertilization								
Bio-1	٧,٠٢	20.46	21.85	35.30	327.36	724.80	200.11	**317.66**
Bio-2	٧,٦٢	22.62	22.74	37.60	356.01	880.94	209.36	**338.37**
Bio-3	٧,٥٤	22.69	24.18	42.00	351.01	986.49	221.97	**629.98**
Bio-4	٧,٤٢	22.33	23.10	39.61	345.23	989.38	212.42	**665.91**
Bio-5	٧,٤٥	21.45	22.03	38.84	344.80	1219.80	202.46	**943.57**
LSD at 0.05	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	١٧٣,٤٧	**N.S**	٥٧,٤١
Interaction								
Solarize	١,٧٧	4.50	3.49	7.04	114.83	211.66	38.39	**63.39**
	١,٩٦	4.75	4.71	7.64	127.40	223.25	51.81	**68.79**
	١,٨٣	5.34	4.38	7.38	119.17	250.98	48.14	**110.65**
	١,٨١	4.62	4.49	7.49	117.43	217.30	49.39	**112.35**
	١,٦٤	4.38	4.22	7.60	106.60	206.02	46.46	**205.29**
Non-solarize	١٢,٢٧	36.41	40.20	63.55	539.88	1237.94	361.83	**571.92**
	١٣,٢٩	40.49	40.77	67.55	584.61	1538.62	366.90	**607.95**
	١٣,٢٥	40.05	43.98	76.62	582.85	1722.01	395.79	**1149.30**
	١٣,٠٢	40.03	41.72	71.73	573.03	1761.47	375.45	**1219.47**
	١٣,٢٥	38.51	39.83	70.08	583.00	2233.58	358.47	**1681.84**
LSD at 0.05	N.S	N.S	N.S	N.S	N.S	٢٤٥,٣٣	N.S	٨١,١٨

Characters	Broad-leaved weeds No		Narrow-leaved weeds No		Broad-leaved weeds fresh weight		Narrow-leaved weeds fresh weight	
Seasons	4 weeks	8 weeks	4 weeks	8 weeks	4 weeks	8 weeks	4 weeks	8 weeks
Solarization								
Solarize	1.80	٤,٧٢	٤,٢٦	٧,٤٣	١١٧,٠٩	٢٢١,٨٤	٤٦,٨٤	١١٢,٠٩
Non-solarize	13.02	٣٩,١٠	٤١,٣٠	٦٩,٩١	٥٧٢,٦٧	١٦٩٨,٧٢	٣٧١,٦٩	١٠٤٦,١٠
LSD at 0.05	**1.20**	١٠,١	٣,٢٦	٤٥,٣٧	٤٥,٢٣	٣٩٢,٢٠	٨٣,٤٣	٩٩,٢١

Bio-fertilization								
Bio-1	٧,٠٢	20.46	21.85	35.30	327.36	724.80	200.11	**317.66**
Bio-2	٧,٦٢	22.62	22.74	37.60	356.01	880.94	209.36	**338.37**
Bio-3	٧,٥٤	22.69	24.18	42.00	351.01	986.49	221.97	**629.98**
Bio-4	٧,٤٢	22.33	23.10	39.61	345.23	989.38	212.42	**665.91**
Bio-5	٧,٤٥	21.45	22.03	38.84	344.80	1219.80	202.46	**943.57**
LSD at 0.05	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	١٧٣,٤٧	**N.S**	٥٧,٤١
Interaction								
Solarize	١,٧٧	4.50	3.49	7.04	114.83	211.66	38.39	**63.39**
	١,٩٦	4.75	4.71	7.64	127.40	223.25	51.81	**68.79**
	١,٨٣	5.34	4.38	7.38	119.17	250.98	48.14	**110.65**
	١,٨١	4.62	4.49	7.49	117.43	217.30	49.39	**112.35**
	١,٦٤	4.38	4.22	7.60	106.60	206.02	46.46	**205.29**
Non-solarize	١٢,٢٧	36.41	40.20	63.55	539.88	1237.94	361.83	**571.92**
	١٣,٢٩	40.49	40.77	67.55	584.61	1538.62	366.90	**607.95**
	١٣,٢٥	40.05	43.98	76.62	582.85	1722.01	395.79	**1149.30**
	١٣,٠٢	40.03	41.72	71.73	573.03	1761.47	375.45	**1219.47**
	١٣,٢٥	38.51	39.83	70.08	583.00	2233.58	358.47	**1681.84**
LSD at 0.05	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	٢٤٥,٣٣	**N.S**	٨١,١٨

Vegetative growth: Effect of soil solarization, ferttization treatments and their interaction on transplant survival ratio, leaves number, plant height and plant fresh weight are presented in Table (4). Transplant survival ratio significantly affected by solarization treatment compared with non-solarize treatment, while fertilization treatments or interactions effects were not significant in both seasons.

Concerning vegetative growth characters, data in table 4 showed that, soil solarization affected positively on strawberry plant height and plant fresh weight compared with non- solarize treatment. While its effects on leaves number was not significant. All vegetative growth characters significantly affected by fertilization treatments. Conventional fertilizer produced the highest leaves number, highest plant height and weightiest plants followed by bio 4 treatment compared with bio 1 which produced the lowest values in this respect, followed by bio 2 and bio 3 in both seasons. Regarding to interaction, data

showed non-significant effects on vegetative growth characters except plant fresh weight character, since conventional fertilizer treatment with solarization gave the heaviest plant fresh weight compared with bio 1 fertilizer with non-solarize treatment in both seasons.

Table: (4) Effect of soil solarization and bio-fertilization on plants survival ratio, average leaves number, plant height and fresh weight of strawberry plants, 8 weeks after transplanting.

Characters	Survival ratio		Leaves No.		Plant height (cm)		Plant fresh weight (g)	
Seasons	1St Season	2nd Season	1St Season	2nd Season	1St Season	2nd Season	1St Season	2nd Season
Solarization								
Solarize	٩٣,٠٣	٩٢,٦٧	٨,٧٠	٨,٥٤	١٥,٢٢	١٥,٠٧	٣٥,١٠	**٣٦,٤٥**
Non-solarize	٧٨,٤٦	٧٦,٢٤	٨,٢٢	٨,١٥	١٣,٥٦	١٤,١٠	٢٨,٧٥	**32.73**
LSD at 0.05	١,٤٨	١,٢٨	**N.S**	**N.S**	١,٢٦	٠,١٨	١,٧٢	١,٩٧
Bio-fertilization								
Bio-1	85.12	84.05	7.41	7.04	13.16	13.16	27.20	**30.71**
Bio-2	86.38	84.40	7.87	7.77	13.52	13.64	28.63	**33.56**
Bio-3	85.36	84.40	8.37	8.47	14.72	15.04	33.66	**34.72**
Bio-4	85.95	83.33	9.28	9.03	15.32	15.37	34.61	**36.49**
Bio-5	85.92	86.07	9.36	9.42	15.24	15.73	35.53	**37.47**
LSD at 0.05	**N.S**	**N.S**	**0.48**	٠,٢٣	**0.62**	**0.76**	**1.05**	٠,٨٨
Interaction								
Solarized	91.67	93.81	7.73	7.11	14.10	13.90	31.44	**34.06**
	93.00	92.38	8.07	8.00	14.39	14.35	33.32	**35.44**
	93.33	93.33	8.55	8.62	15.41	15.40	35.47	**36.16**
	94.05	90.00	9.55	9.31	16.21	15.75	36.95	**37.94**
	93.10	93.81	9.59	9.66	16.00	15.97	38.33	**38.66**
Non-solarized	78.57	74.29	7.09	6.98	12.23	12.41	22.96	**27.36**
	79.76	76.43	7.67	7.54	12.64	12.93	23.93	**31.69**
	77.38	75.48	8.18	8.32	14.03	14.67	31.85	**33.29**
	77.86	76.67	9.01	8.74	14.42	14.98	32.27	**35.03**
	78.74	78.33	9.13	9.17	14.48	15.48	32.73	**36.28**
LSD at 0.05	N.S	N.S	N.S	N.S	N.S	N.S	١,٤٩	١,٢٤

Characters	Survival ratio		Leaves No.		Plant height (cm)		Plant fresh weight (g)	
Seasons	1St Season	2nd Season	1St Season	2nd Season	1St Season	2nd Season	1St Season	2nd Season
Solarization								
Solarize	٩٣,٠٣	٩٢,٦٧	٨,٧٠	٨,٥٤	١٥,٢٢	١٥,٠٧	٣٥,١٠	**٣٦,٤٥**
Non-solarize	٧٨,٤٦	٧٦,٢٤	٨,٢٢	٨,١٥	١٣,٥٦	١٤,١٠	٢٨,٧٥	**32.73**
LSD at 0.05	١,٤٨	١,٢٨	**N.S**	**N.S**	١,٢٦	٠,١٨	١,٧٢	١,٩٧
Bio-fertilization								
Bio-1	85.12	84.05	7.41	7.04	13.16	13.16	27.20	**30.71**
Bio-2	86.38	84.40	7.87	7.77	13.52	13.64	28.63	**33.56**
Bio-3	85.36	84.40	8.37	8.47	14.72	15.04	33.66	**34.72**
Bio-4	85.95	83.33	9.28	9.03	15.32	15.37	34.61	**36.49**

Bio-5	85.92	86.07	9.36	9.42	15.24	15.73	35.53	**37.47**
LSD at 0.05	**N.S**	**N.S**	**0.48**	٠,٢٣	**0.62**	**0.76**	**1.05**	٠,٨٨
				Interaction				
Solarized	91.67	93.81	7.73	7.11	14.10	13.90	31.44	**34.06**
	93.00	92.38	8.07	8.00	14.39	14.35	33.32	**35.44**
	93.33	93.33	8.55	8.62	15.41	15.40	35.47	**36.16**
	94.05	90.00	9.55	9.31	16.21	15.75	36.95	**37.94**
	93.10	93.81	9.59	9.66	16.00	15.97	38.33	**38.66**
Non-solarized	78.57	74.29	7.09	6.98	12.23	12.41	22.96	**27.36**
	79.76	76.43	7.67	7.54	12.64	12.93	23.93	**31.69**
	77.38	75.48	8.18	8.32	14.03	14.67	31.85	**33.29**
	77.86	76.67	9.01	8.74	14.42	14.98	32.27	**35.03**
	78.74	78.33	9.13	9.17	14.48	15.48	32.73	**36.28**
LSD at 0.05	N.S	N.S	N.S	N.S	N.S	N.S	١,٤٩	١,٢٤
Characters	Survival ratio		Leaves No.		Plant height (cm)		**Plant fresh weight (g)**	
Seasons	**1St Season**	**2nd Season**	**1St Season**	**2nd Season**	**1St Season**	**2nd Season**	**1St Season**	**2nd Season**
				Solarization				
Solarize	٩٣,٠٣	٩٢,٦٧	٨,٧٠	٨,٥٤	١٥,٢٢	١٥,٠٧	٣٥,١٠	٣٦,٤٥
Non-solarize	٧٨,٤٦	٧٦,٢٤	٨,٢٢	٨,١٥	١٣,٥٦	١٤,١٠	٢٨,٧٥	**32.73**
LSD at 0.05	١,٤٨	١,٢٨	**N.S**	**N.S**	١,٢٦	٠,١٨	١,٧٢	١,٩٧
				Bio-fertilization				
Bio-1	85.12	84.05	7.41	7.04	13.16	13.16	27.20	**30.71**
Bio-2	86.38	84.40	7.87	7.77	13.52	13.64	28.63	**33.56**
Bio-3	85.36	84.40	8.37	8.47	14.72	15.04	33.66	**34.72**
Bio-4	85.95	83.33	9.28	9.03	15.32	15.37	34.61	**36.49**
Bio-5	85.92	86.07	9.36	9.42	15.24	15.73	35.53	**37.47**
LSD at 0.05	**N.S**	**N.S**	**0.48**	٠,٢٣	**0.62**	**0.76**	**1.05**	٠,٨٨
				Interaction				
Solarized	91.67	93.81	7.73	7.11	14.10	13.90	31.44	**34.06**
	93.00	92.38	8.07	8.00	14.39	14.35	33.32	**35.44**
	93.33	93.33	8.55	8.62	15.41	15.40	35.47	**36.16**
	94.05	90.00	9.55	9.31	16.21	15.75	36.95	**37.94**
	93.10	93.81	9.59	9.66	16.00	15.97	38.33	**38.66**
Non-solarized	78.57	74.29	7.09	6.98	12.23	12.41	22.96	**27.36**
	79.76	76.43	7.67	7.54	12.64	12.93	23.93	**31.69**
	77.38	75.48	8.18	8.32	14.03	14.67	31.85	**33.29**
	77.86	76.67	9.01	8.74	14.42	14.98	32.27	**35.03**

	78.74	78.33	9.13	9.17	14.48	15.48	32.73	**36.28**
LSD at 0.05	N.S	N.S	N.S	N.S	N.S	N.S	١,٤٩	١,٢٤
Characters	Survival ratio		Leaves No.		Plant height (cm)		**Plant fresh weight (g)**	
Seasons	**1St Season**	**2nd Season**	**1St Season**	**2nd Season**	**1St Season**	**2nd Season**	**1St Season**	**2nd Season**
				Solarization				
Solarize	٩٣,٠٣	٩٢,٦٧	٨,٧٠	٨,٥٤	١٥,٢٢	١٥,٠٧	٣٥,١٠	٣٦,٤٥
Non-solarize	٧٨,٤٦	٧٦,٢٤	٨,٢٢	٨,١٥	١٣,٥٦	١٤,١٠	٢٨,٧٥	**32.73**
LSD at 0.05	١,٤٨	١,٢٨	**N.S**	**N.S**	١,٢٦	٠,١٨	١,٧٢	١,٩٧
				Bio-fertilization				
Bio-1	85.12	84.05	7.41	7.04	13.16	13.16	27.20	**30.71**
Bio-2	86.38	84.40	7.87	7.77	13.52	13.64	28.63	**33.56**
Bio-3	85.36	84.40	8.37	8.47	14.72	15.04	33.66	**34.72**
Bio-4	85.95	83.33	9.28	9.03	15.32	15.37	34.61	**36.49**
Bio-5	85.92	86.07	9.36	9.42	15.24	15.73	35.53	**37.47**
LSD at 0.05	**N.S**	**N.S**	**0.48**	٠,٢٣	**0.62**	**0.76**	**1.05**	٠,٨٨
				Interaction				
Solarized	91.67	93.81	7.73	7.11	14.10	13.90	31.44	**34.06**
	93.00	92.38	8.07	8.00	14.39	14.35	33.32	**35.44**
	93.33	93.33	8.55	8.62	15.41	15.40	35.47	**36.16**
	94.05	90.00	9.55	9.31	16.21	15.75	36.95	**37.94**
	93.10	93.81	9.59	9.66	16.00	15.97	38.33	**38.66**
Non-solarized	78.57	74.29	7.09	6.98	12.23	12.41	22.96	**27.36**
	79.76	76.43	7.67	7.54	12.64	12.93	23.93	**31.69**
	77.38	75.48	8.18	8.32	14.03	14.67	31.85	**33.29**
	77.86	76.67	9.01	8.74	14.42	14.98	32.27	**35.03**
	78.74	78.33	9.13	9.17	14.48	15.48	32.73	**36.28**
LSD at 0.05	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	١,٤٩	١,٢٤

These results indicated that, the changes in soil properties due to solarization may have positive effect vegetative growth characters of strawberry plants, in addition that, soil temperature effects, soil microorganisms and weed control revealed, solarization caused beneficial conditions such as enhancement of soil physiology properties, availability of nutrients, weed eradication, inhibition of pathogens and stimulation of beneficial microorganisms which were add as a bio-fertilizers **(Stapleton,**

1991; Hartz *et al*., 1993; Camprubi *et al*., 2007). However, conventional treatment produced the vigorous plants compared with other treatments especially bio-1 and bio-2 which received least amount of chemical fertilizers and consequently gave lowest vegetative growth. Similar results were found by **(El-Miniawy *et al*., 2014** and **Gomaa *et al*., 2016)**.

Yield and its component:

Data presented in Table (5) showed that, soil solarization and bio-fertilization significantly affected on early yield per plant, total yield per plant, total yield per plot and average fruit weight in both season, while interaction effects were not significant except early yield character in both seasons. Soil solarization increased early yield, total yield per plant, total yield per plot and average fruit weight as compared with non-solarize treatment in both seasons. Conventional fertilization and bio-4 treatments gave the highest early and total yield per plant followed by bio-3 compared with bio-1 treatment, which gave the lowest values in this respect. Also, conventional treatment significantly increased total yield per plot and average fruit weight followed by bio-4 then bio-3 treatment compared with bio-1 which gave the lowest values followed by bio-2 in both seasons. Regarding interaction effect on early yield, conventional and bio-4 with solarization produced the highest significant early yield compared with bio-1 with solarize or non-solarize in both seasons. Generally, solarization enhanced strawberry yield characters and the increment was most pronounced with increasing chemical fertilizer rate by one hundred percent and three quarter. Also, solarization superiority was evident on total yield per plot compared with other characters may be due to it's a positive effects on plants survival ratio, fruits rot percent and weeds growth suppression and consequently absent the competition especially at the early

growing stage. In order to that, strawberry plants had advantage to increasing growth compared with non-solarize treatment. These results indicated that, the changing in soil properties resulted from solarization may have a positive effect on transplants standing and improve its survival which resulted more plants per unit area **(Candido *et al.*,2008)**, improvement vegetative growth **(Porras *et al*., 2007).** Our previus data on soil temperatures, soil microorganisms and weed control (Tables 1,2,3 and 4) revealed that, solarization caused a good conditions such as improving chemical and physical properties and availability of nutrients, eradication of annual weeds as well as inhibition of pathogens and stimulation of beneficial microorganisms. This conditions led stimulate strawberry growth especially at early stages and consequently increased growth, early yield and total yield of strawberry (**Domínguez *et al*., 2014 and Ozyilmaz *et al*., 2016)**. Moreover, adding bio fertilizers relatively enhanced soil population of microorganism at end of season compared with transplanting time, where, the most counts of microorganisms in solarized plots belonged to beneficial groups **(Stapleton, 1991)**. So, adding bio-fertilizers enhance the efficacy of solarization and gave unfortunately for beneficial microorganisms (bio-fertilizers) to living and flourish **(Gomaa, (2008)**. Increasing strawberry growth
and yield and enhancement of its fruit quality were reported by many researchers **(El-Miniawy *et al.*, 2014 and Gomaa *et al.*, 2016).**

Table: (5) Effect of soil solarization and bio-fertilization on average fruit weight, early yield/plant, total yield/plant and total yield/plot of strawberry plants.

Characters	Average fruit weight (g)		Early yield/plant (g)		Total yield/plant (g)		Total yield/plot (kg)	
Seasons	1St Season	2nd Season	1St Season	2nd Season	1St Season	2nd Season	1St Season	2nd Season
Solarization								
Solarize	١٢,٢٩	١٢,٤٢	٢١٠,٩	٢٢٥,٦	٤١٦,٦	٤٢٢,٢	٥٤,٠٤	٥٤,٣٣
Non-solarize	١٠,٨٣	١١,٢٠	١٧٤,١	١٨٣,٨	٣٧٠,٤	٣٨٤,٥	٣٩,٥٧	٣٩,٥٠
LSD at 0.05	٠,١٥٤	٠,٤٢	١٢,٢	١٤,٦	٢٦,٨	٢٥,٩	٣,٨٧	٢,٢٥
Bio-fertilization								
Bio-1	9.67	9.79	152.8	172.5	324.7	336.7	38.58	**38.51**
Bio-2	10.86	11.16	187.8	203.2	367.5	377.9	44.20	**44.32**
Bio-3	11.81	12.06	196.7	208.3	391.7	405.0	46.48	**47.41**
Bio-4	12.28	12.61	208.4	215.0	427.5	439.8	50.80	**50.43**
Bio-5	13.19	13.42	216.6	224.7	456.1	457.1	53.87	**53.91**
LSD at 0.05	**0.48**	٠,٥٧	**8.6**	١٢,٥	١٤,٤	**24.9**	**2.27**	٢,٩٧
Interaction								
Solarize	10.50	10.16	155.3	175.3	341.8	341.1	43.67	**44.63**
	11.63	11.96	206.9	224.4	386.6	393.7	50.12	**50.63**
	12.51	12.68	218.6	235.3	417.6	430.9	54.30	**56.00**
	13.20	13.53	233.1	243.1	449.2	460.5	58.84	**57.56**
	13.63	13.76	240.4	250.3	488.0	484.4	63.09	**62.84**
Non-solarize	8.84	9.41	150.3	169.9	307.6	332.3	33.49	**32.40**
	10.09	10.35	168.8	182.2	348.4	362.1	38.29	**38.01**
	11.11	11.44	174.7	181.4	365.8	379.1	38.66	**38.83**
	11.36	11.69	183.6	186.9	405.8	419.0	42.75	**43.29**
	12.75	13.08	192.9	199.6	424.1	429.8	44.65	**44.99**
LSD at 0.05	**N.S**	**N.S**	**12.1**	١٧,٦	**N.S**	**N.S**	**N.S**	**N.S**

Fruits quality:

The effect of soil solarization, bio-fertilization and interaction on strawberry fruit firmness, T.S.S and L. Ascorbic acid content are presented in Table, (6). Solarization significantly enhanced fruit firmness compared with non-solarize treatment, while the same treatment had not have significant effect on strawberry fruit T.S.S or L. Ascorbic acid content in both seasons.

Concerning of bio-fertilization effect, data in Table (6) showed that, fruit firmness, T.S.S and L. Ascorbic acid content significantly affected by bio-fertilization treatments. Bio-3 in first season, bio-3 with bio-2 in the second gave the highest fruit firmness followed by other bio-fertilizer treatments as compared with conventional treatment which produced the lowest fruit firmness in both seasons. Bio-3 alone or bio-3 and bio-2 gave the highest T.S.S values in first and second seasons respectively compared with conventional treatment which gave the lowest value. Moreover, Highest L. Ascorbic acid content obtained with bio-3 or bio-3 and bio-4 in the first and second seasons respectively compared with bio-1 and conventional treatments which produced the lowest fruit L. Ascorbic acid content in both seasons. All interactions effect on the tree characters were not significant in both seasons.

Table: (6) Effect of soil solarization and bio-fertilization on Fruit firmness, T.S.S content and L. Ascorbic acid (mg/100g F.W.) in 2017 and 2018 seasons.

Characters	Fruit firmness (g/cm^2)		T.S.S content		L. Ascorbic acid (mg/100g F.W.)	
Seasons	**1St Season**	**2nd Season**	**1St Season**	**2nd Season**	**1St Season**	**2nd Season**
Solarization						
Solarize	٤٤٣,٢	٤٥٢,٢	٨,٣٨	٨,٤٧	٦٤,٨٨	٦٣,٨٩
Non-solarize	٤٢٦,٨	٤٢٤,٦	٨,٢٣	٨,١٣	٦٣,٥١	٦٥,٤٣
LSD at 0.05	١٤,٩	١١,٦	**N.S**	**N.S**	**N.S**	**N.S**
Bio-fertilization						
Bio-1	445.7	447.9	8.37	8.37	61.50	**62.60**
Bio-2	451.3	468.5	8.46	8.52	63.18	**63.37**
Bio-3	466.4	462.6	8.61	8.55	69.12	**68.23**
Bio-4	424.1	406.6	8.18	8.40	64.83	**66.95**
Bio-5	379.9	406.2	7.93	7.94	62.37	**62.15**
LSD at 0.05	١٣,٣	٩,١	٠,١٣	٠,١١	١,٩٨	٢,٦٤
Interaction						
Solarize	450.9	469.2	8.41	8.47	61.86	**60.67**
	455.7	473.7	8.55	8.56	63.32	**63.18**
	472.4	476.8	8.77	8.71	68.75	**68.36**
	442.3	420.9	8.23	8.52	66.08	**66.66**
	379.5	420.2	7.97	8.12	64.41	**60.58**
Non-solarize	440.4	426.7	8.33	8.27	61.15	**64.53**
	446.9	463.3	8.36	8.49	63.04	**63.56**
	460.4	448.3	8.45	8.39	69.48	**68.10**
	405.8	392.2	8.12	8.29	63.58	**67.24**
	380.3	392.3	7.89	7.76	60.32	**63.72**
LSD at 0.05	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**

Fruit rot and absent yield: Data in Table, 7 showed that, soil solarization significantly decreased rotted fruits even gray mold rot caused by *Botrytis cinerea* or dry rot caused by *Phytophthora cactorum* compared with non-solarize treatments in both seasons. This resulted in more lost fruit yield especially in the first season. Also, rotted fruits significantly affected by bio fertilizer treatments, where the rotted fruits increased with increasing chemical fertilizers ratio and bio 1 treatment (without chemical fertilzer) produced the lowest value compared with other treatments. On the other hand, control treatment (traditional) gave the highest number of rotted fruits in both seasons. Regarding lost yield per plot, data showed the same trend, where, control treatment produced the highest value compared with bio-fertilozers treatments and the lost yield was increased with increasing chemical fertilizer ratio in both seasons.

Decreasing of disease incidence due to solarization may be attributed to the production of NH3 and an increase in soil microbial activity, which can help control soilborne pathogens through competition, antibiosis, parasitism/predation, etc. **(Nunez-Zofio *et al.* 2011; Martinez *et al.* 2011)**. Most pathogens affected was *Verticillium dahliae* **(Daugovish *et al.* 2011),** *P. cactorum* **(Porras, *et al.*, 2007)**. Microbiological changes in soil environment have also been documented as a mechanism of pathogen suppression and resulting improved crop productivity **(Mazzola, 2011)**.

Table: (7) Effect of soil solarization and bio-fertilization on Total rotted fruit/ plot, Botrytis gray mold rot, Dry rot and Absent yield in 2017 and 2018 seasons.

Characters	Total rotted fruit/ plot		Botrytis gray mold rot		Dry rot		Absent yield	
Seasons	1St Season	2nd Season	1St Season	2nd Season	1St Season	2nd Season	1St Season	2nd Season
Solarization								
Solarize	٢٤,٣٣	٢٩,٢٦	١٩,٥٨	٢٣,٤٩	٤,٧٤	٥,٧٧	٣٠٢,٦	**419.7**
Non-solarize	٩٣,٢٦	١٠٣,٣٢	٨٦,٠٢	٩٥,٦٩	٧,٢٤	٧,٦٣	٢٠٩٨,١	١٢٥٨,٢
LSD at 0.05	٧,٥٠	٢,٩٤	٧,٢٩	٣,٥٧	٠,٩٤	١,١١	١٣٢,١	٤٢,٠
Bio-fertilization								
Bio-1	29.22	36.11	29.68	27.05	8.35	9.06	273.9	**348.6**
Bio-2	37.55	42.95	48.61	36.15	6.25	6.81	438.4	**506.6**
Bio-3	57.22	61.04	86.54	55.73	4.18	5.32	618.2	**802.6**
Bio-4	76.56	88.18	123.19	81.89	5.23	6.29	892.9	**1072.4**
Bio-5	93.44	103.17	142.09	97.14	5.96	6.03	1309.4	**1464.5**
LSD at 0.05	٣,٩٢	٥,١٩	٣,٥٢	٥,٠٣	١,٠٩	١,٢٢	**72.6**	٧٣,٢
Interaction								
Solarize	18.76	22.42	12.05	15.38	6.71	7.04	196.7	**228.21**
	19.45	23.57	13.98	18.36	5.47	5.21	226.1	**281.97**
	22.43	25.76	19.53	22.24	2.90	3.53	259.7	**370.35**
	23.44	31.36	19.48	25.64	3.96	5.72	309.6	**459.02**
	37.55	43.18	32.87	35.84	4.68	7.34	520.7	**759.03**
Non-solarize	39.67	49.79	29.68	38.71	9.99	11.08	351.2	**469.04**
	55.65	62.33	48.61	53.94	7.04	8.40	650.7	**731.32**
	92.00	96.32	86.54	89.22	5.46	7.10	976.8	**1234.89**
	129.68	145.01	123.19	138.14	6.49	6.87	1476.2	**1685.77**
	149.32	163.16	142.09	158.44	7.23	4.72	2098.1	**2169.96**
LSD at 0.05	٥,٥٤	٧,٣٤	٤,٩٨	٧,١١	**N.S**	١,٧٢	**102.6**	١٠٣,٥

Conclusion: the present results indicate that soil solarization has the potential for nonchemical management of soilborne diseases of strawberry and it may be possible to grow strawberries at Siwa oasis with soil solarization and without chemical fertilizers or with limited

amounts of fertilizers. Although the highest yield was obtained by soil solarization with adding recommended chemical fertilizers, we can achieve a proper strawberry yield with application of bio-fertilizers combine with half or one-fourth of recommended doses. Moreover, soil solarization with bio-fertilizers produced the highest fruits quality as well as lowest rotted fruits ratio. Finally, solarization has potential as a component in an integrated pest management program of fruit rot diseases in strawberry production, particularly at areas have hot summer like Siwa oasis.

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Covid 19 vaccines review

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Introduction

Vaccine is the magic solution for saving the life in humans and animals. The mechanisms of different prepared vaccines immunity against different pathogens are illustrated in **figure 1**. The different vaccine platforms have their advantages and disadvantages. Live-attenuated platforms offer higher immunogenicity in spite of pose safety concerns due to retained pathogenicity of pathogens. The killed vaccines elicit moderate levels of immunogenicity and higher levels of safety compared to the live attenuated vaccine platforms. [1].

To combat Covid 19 vaccine, the behavioral and therapeutic strategies are essential but they must be accompanied with the long-term goal of a preventative vaccine **virus.** In the case of COVID-19, the pathogen is the virus SARS-CoV-2, a vaccine can use. A virus that has been modified to be safe or a molecule that resembles a part of the virus. Once antibodies are eliminated, if the vaccinated person is exposed later to the virus, their body will produce those antibodies again, increasing their chances of fighting off infection **.Today, there are more than 150 COVID-19 vaccines in the race to mollify the virus.** Researchers develop a vaccine candidate similar to that target that will induce production of antibodies effective against the virus. The vaccine candidate is then moved through phases of development, assessment, and approvals (figure**.** 2) [2].

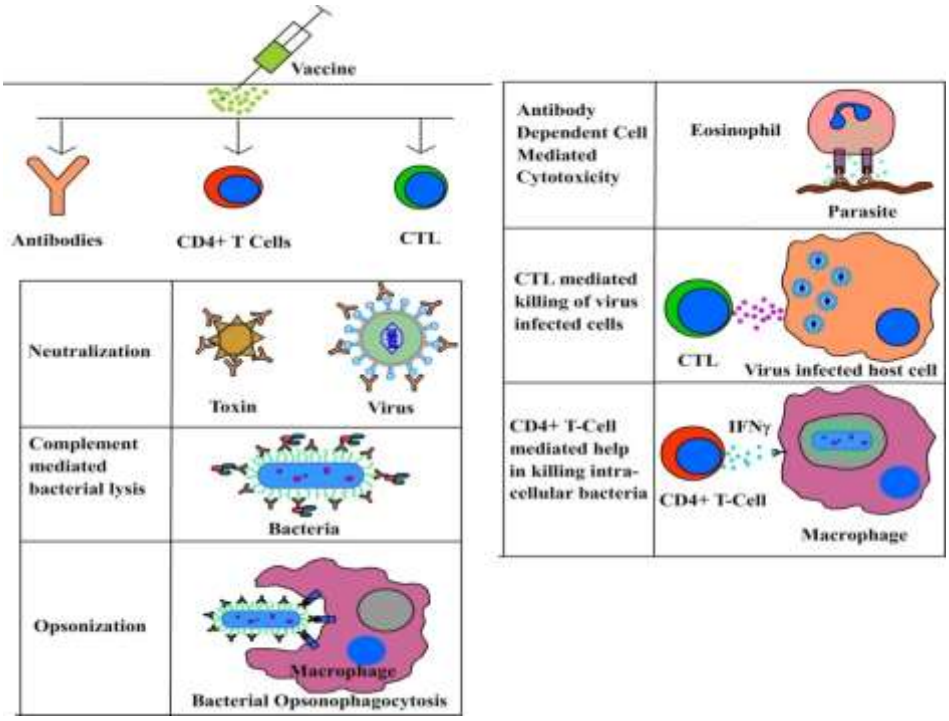
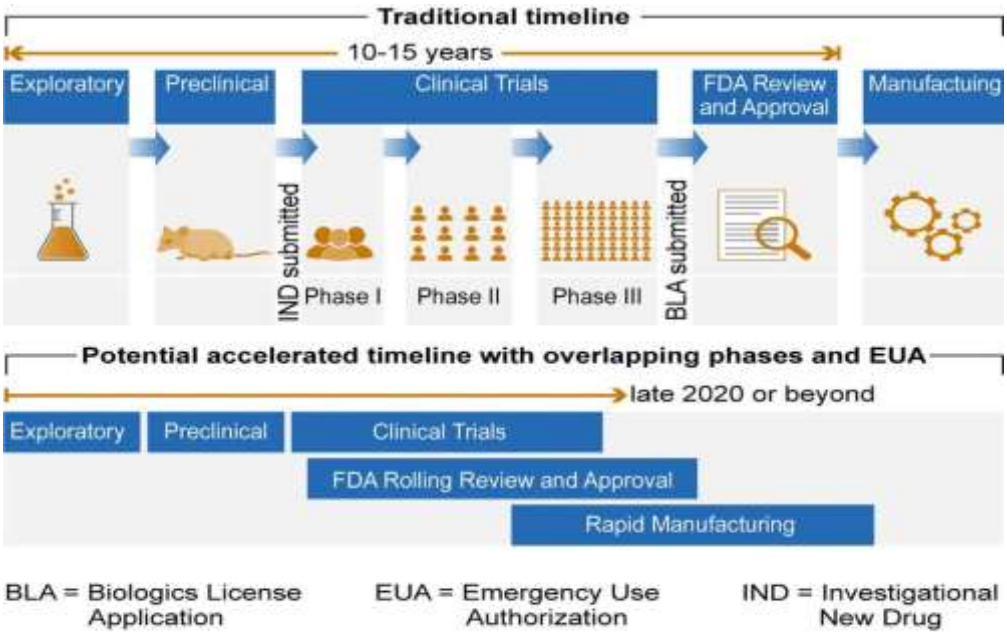


Figure 1. (Immunity response for administration of different prepared vaccines)



Source: GAO analysis of GAO-20-215SP, FDA, HHS, and Pharmaceutical Research and Manufacturers of America (PhRMA) documentation. | GAO-20-583SP

Figure (2). The vaccine development process almost takes 10 to 15 years under routine timeline. Several regulatory pathways, e.g. Emergency Use Authorization, can be applied to produce fast COVID-19 market vaccine

As of May 15, 2020, there are more than 110 COVID-19 vaccines in development globally; of those, at least three are being developed in the United States with federal funding. These three use different mechanisms to prompt the body to produce antibodies **(fig. 3).** Consecutive testing of several vaccine mechanisms able to improve the chances for effective development of a successful vaccine faster. **One to three these vaccines have already reached Phase III clinical trials in less than a year; an unprecedented time [3].**

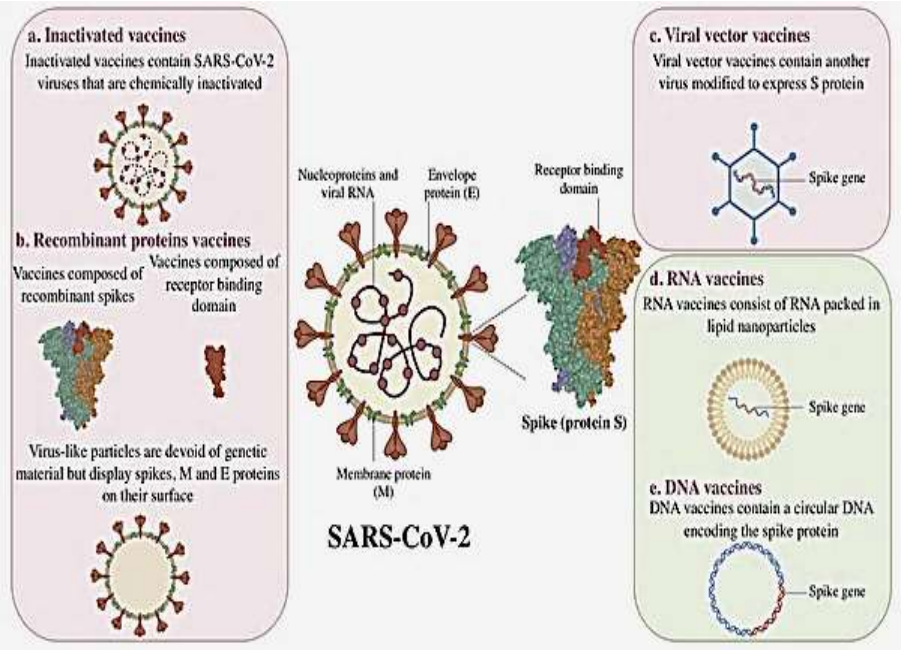


Figure (3) Vaccine candidates for production of covid19 vaccines

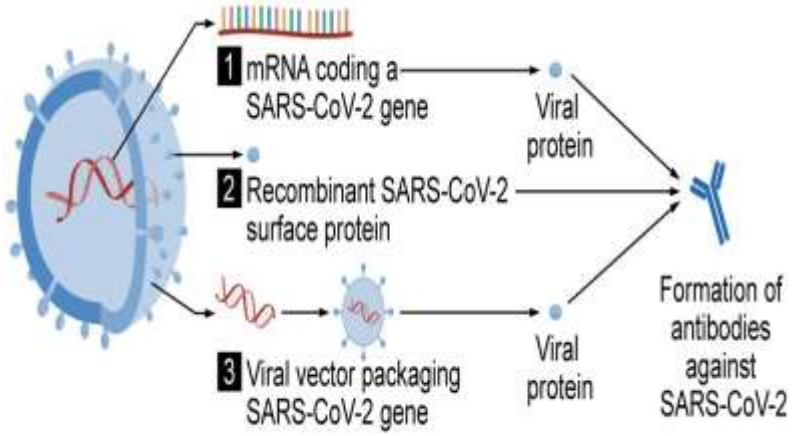
Trials of vaccine candidates

1. Inactivated vaccines

Since the 1880s, inactivated vaccines have been used. The viruses in these vaccines had inactivated by chemical treatment, as with SARS-CoV-2 candidate vaccines, or by physical treatment. B-propiolactone inactivated aluminum-adjuvanted whole-virion SARS-CoV-2 vaccine developed by Wuhan Institute of Biological Products [4].The immune system in these cases encounters the virus in its entirety. It can mount a defense when it detects the viral spike protein (spicule or S-protein), envelope and nucleoprotein. Currently, seven inactivated vaccine candidates are being tested in humans. Of these, three are in Phase 3 clinical trials. Unlike Phase 1 and Phase 2, which are used to evaluate a vaccine's tolerability, safety and ability to

induce an immune response, a Phase 3 clinical trial allows scientists to test its efficacy [5]

Once the sequencing of SARS-CoV-2 gnome becomes available, several nucleic acid based vaccine candidates start proposing for preparation depends on S protein coding sequence. The different mechanisms developed by vaccine candidates are illustrated in **figure (4).**



Source: GAO. | GAO-20-583SP

Figure (4). Vaccine candidates use different mechanisms, to prompt the body to produce antibodies against SARS-CoV-2

2. Bioengineered vaccines.

2.1. m-RNA vaccines

The first candidate, established by National Institute of Allergy and Infectious Diseases scientists and their collaborators, uses a molecule called mRNA specifically coded to generate proteins that will induce an immune response. This is a newer method of vaccine development that has shown promise in animals during the preclinical phase.

2.1.1.The BioNTech technology for the BNT162b2 vaccine candidate is based on use of messenger RNA (mRNA) which

encodes part of the spike protein found on the surface of the SARS-CoV-2 coronavirus (COVID-19), triggering an immune response against infection by the virus protein. The mRNA is encapsulated in lipid nanoparticles. The mutated version of the spike protein contains two proline substitutions (designated "2P") that cause it to adopt a shape that stimulates neutralizing antibodies [6][7]. **In December 2020**, this vaccine was administered in USA and approved to be used in united Kingsom

2.1.2. Moderna' m-RNA-1273 is a synthetic messenger RNA strand which encodes the prefusion-stabilized viral spike protein. When administered I/M, it produce antiviral immunity specifically to SARS-CoV-2 Spike protein inside muscle cells. Which reaches peak levels for 24 to 48 hours and can last for a few more days.

Besides, unlike conventional vaccines, which are either made from inactivated pathogen or small subunits of live pathogen, synthesis of the lipid nanoparticle-encapsulated mRNA vaccine does not require the virus. Therefore, it is relatively safe and ready to be tested. If mRNA-1273 proves to be safe for humans and pass the phase I trial, successive evaluation of its efficacy will be carried out immediately. [8]

2.2. DNA vaccine

2.2.1. INO-4800 is a DNA vaccine candidate created by **Inovio Pharmaceuticals**. It is also a genetic vaccine that can be brought to human cells and translated into proteins to produce immune responses. Compared to traditional vaccines, genetic vaccines require lower costs of production and easier way of purification. The simple structure of nucleic acids also obviates the risk of incorrect folding, which could occur in recombinant protein-based vaccines. However, the amount of plasmid delivered and the adequate interval and route of administration are the factors that may influence the immunogenicity of genetic vaccines [9][10].

2.2.2. Covigenix Vaccine

Unlike traditional vaccines, a DNA-based vaccine involves the direct introduction of a plasmid encoding the antigen(s) against which an immune response is sought and relies on the production of the target antigen in the patient's own cells. This approach offers a number of potential advantages over traditional approaches, including the stimulation of B- and T-cell responses, ease of large-scale manufacture, improved vaccine stability, and the absence of any infectious agent. Until recently, medicines capable of effectively delivering DNA have faced significant challenges in their development. Covigenix Vaccine, Entos' Fusogenix Platform, is a proteo-lipid vehicle (PLV) that uses a novel fusion mechanism to deliver its genetic payload directly inside cells. Entos has developed unique formulations to effectively deliver a wide range of genetic therapies, including plasmid DNA. The use of plasmid DNA in a vaccine will allow Entos to design an optimized payload encoding multiple protein epitopes from key immunogenic SARS-COV-2 proteins. These protein epitopes will stimulate the body's natural antibody production and protective immune response to prevent COVID-19 disease [11].

2.3. Viral vector vaccines

2.3.1. Viral replicating vector vaccines

This approach is based on using a virus that is non-pathogenic or of little danger to humans. In the case of the 12 vaccine candidates of this type currently being studied in humans, the viral vectors are mostly **adenoviruses**. They have a large group of viruses which usually cause colds and conjunctivitis, among other manifestations.

The candidate uses a virus—adenovirus 26, or Ad26—but researchers have removed its infectious aspects, making it safe as a "vector" to deliver a piece of SARS-CoV-2 to trigger a

protective immune response. This method is also in clinical trials against HIV and Ebola. The process for developing a new vaccine as outlined by the Food and Drug Administration (FDA) is well established. In the exploratory phase, the target and candidate vaccine are identified. In the preclinical phase, researchers use cells and animals to assess safety and produce evidence of clinical promise, evaluated by the candidate's ability to elicit a protective immune response.

2.3.1.1. The Sputnik V vaccine

It made by the Gamaleya Center for Epidemiology and Microbiology in Moscow, uses adenovirus (Ad) "vectors" to deliver a gene that codes for the surface protein, spike, of SARS-CoV-2, the virus that causes COVID-19. The two-dose scheme begins with an Ad26-spike vaccine and is followed by a booster shot 21 days later that contains Ad5 spike. Gamaleya chose two different adenoviruses because of concerns that immune responses to the same vector could lower the impact of the booster shot. Joining the flood of press releases announcing positive results from COVID-19 vaccine trials, developers of Russia's Sputnik V vaccine today reported 91.4% efficacy from a second interim analysis of more than 18,000 people, bolstering a claim the team made on 11 November 2020 with scant evidence. Whereas the initial report rested on a mere 20 cases of COVID-19, with no details on how they were split between vaccinated and placebo groups, the new analysis is based on 39 cases total, eight among the vaccinated group versus 31 in the much smaller placebo arm. "This is great news not just for Russia, but the world," Kirill Dmitriev, CEO of the Russian Direct Investment Fund that is bankrolling the development of the candidate One adenovirus benefit vaccines is stored in standard refrigerators, rather than needing freezers **[12]**.

2.3.1.2.Gam-COVID-Vac is a viral two-vector vaccine based on the human adenovirus — a common cold virus — fused with the spike protein of SARS-CoV-2 to stimulate an immune response. The Gam-COVID-Vac vaccine candidate was developed by a government organization that worked on previous coronavirus vaccine candidates.
The recombinant adenovirus type-5 (Ad5) and adenovirus type-26 (Ad26) are both used as vectors in the vaccine. The Ad26 based vaccine is used on the first day and the Ad5 vaccine is used on the 21st day to boost response. The liquid form of the vaccine must be stored at −18 °C (0 °F), and a freeze-dried form is currently being tested that would allow storage at the standard temperature of 2–8 °C (36–46 °F**)**[13].

2.3.2. Non-replicating viral vector vaccines

2.3.2.1. The ChAdOx1 nCoV-19 vaccine (AZD1222) AstraZeneca's vaccine

It consists of the replication-deficient simian adenovirus vector ChAdOx1, containing the full-length structural surface glycoprotein (spike protein) of SARS-CoV-2, with a tissue plasminogen activator leader sequence. ChAdOx1 nCoV-19 expresses a codon-optimized coding sequence for the spike protein (GenBank accession number MN908947).This vaccine, developed by the University of Oxford, has entered a phase I/II clinical trial (NCT04324606). The non-replicating nature of adenovirus in the host makes it relatively safe in children and individuals with underlying diseases. Besides, the adenovirus-based vectors are characterized by a broad range of tissue tropism that covers both respiratory and gastrointestinal epithelium, the two main sites that express the ACE-2 receptor of SARS-CoV-2. However, the possibility of dominant immunogenicity toward the vector genes rather than the transgenes should always be considered [14].

2.4. Recombinant proteins

The second candidate uses a recombinant protein, which is produced by genetically engineering bacteria or other cells to produce a protein that mimics part of the spike protein found on the surface of the SARS-CoV-2 virus. The spike protein alone does not cause an infection but may be sufficient to produce an immune response. Recombinant protein vaccines are already being used successfully against other viruses, such as the human papillomavirus (HPV), which can cause cervical cancer. Recombinant protein vaccines fall into two categories: subunit and virus-like particle vaccines. For subunit protein vaccines, a viral protein is produced in large quantities in a living "factory," such as a bacterium, plant, mammalian or insect cell. When the viral protein is presented to the immune system, it triggers a reaction.

2.4.1. Subunit vaccines

The University of Queensland (QLD, Australia) is leveraging on its S-spike vaccine. The candidate has been developed via molecular clamp technology, which uses a lab-created polypeptide to pin the spike protein in its tortile position so that the body's immune system can target it before the virus has a chance to activate**.** Stabilized Subunit Vaccines Enveloped viruses require fusion of the viral membrane with the host cell membrane for infection. This process involves the conformational change of the viral glycoprotein from the pre-fusion form to the post-fusion form. Although the pre-fusion glycoproteins are relatively unstable, they are still able to elicit strong immune responses**.** Thus, the University of Queensland is developing a stabilized subunit vaccine based on the molecular clamp technology, which would allow recombinant viral proteins to stably remain in their pre-fusion form. Previously applied to influenza virus and Ebola virus, molecular clamp vaccines have proved their capacity to induce the production of neutralizing

antibodies. They were also reported to be potent after two weeks at 37 ◦C. Subunit vaccines have highest degree of safety profile however, have low immunogenicity and requires multiple booster doses to induce adequate immunity. On the other hand, subunit vaccines are also limited in their ability to induce cell mediated immune response [15].

2.4.2. Virus-like particle vaccines

Virus-like particle vaccines are composed of a set of viral proteins that mimic the shape of the virus. This particle "pseudo-virus" is an empty shell, devoid of genetic material and non-infectious, but this does not prevent the immune system from recognizing it. The 13 subunit vaccine candidates currently in Phase 1, 2 or 3 clinical trials are composed of either the entire spike protein or a specific portion of the spike protein called the 'receptor binding domain'.

2.5.Nano particle-Based Vaccines

Nanoparticle-based platforms represent an alternative strategy to incorporate antigens. Through encapsulation or covalent functionalization, nanoparticles can be conjugated with antigenic epitopes, mimic viruses and provoke antigen-specific lymphocyte proliferation as well as cytokine production. In addition, mucosal vaccination through intranasal or oral spray can not only stimulate immune reactions at the mucosal surface, but also provoke systemic responses. This demonstrates the potential of nanoparticle-based vaccines to protect humans against respiratory viruses that cause systemic symptoms. Nano vaccines Evoke a strong immune response ,as shown **in figure (5),** with advantage of nano-sized range, high antigen load, accelerate immunogenicity, controlled antigen presentation, more retention in lymph node , reduce vaccine dose[16].

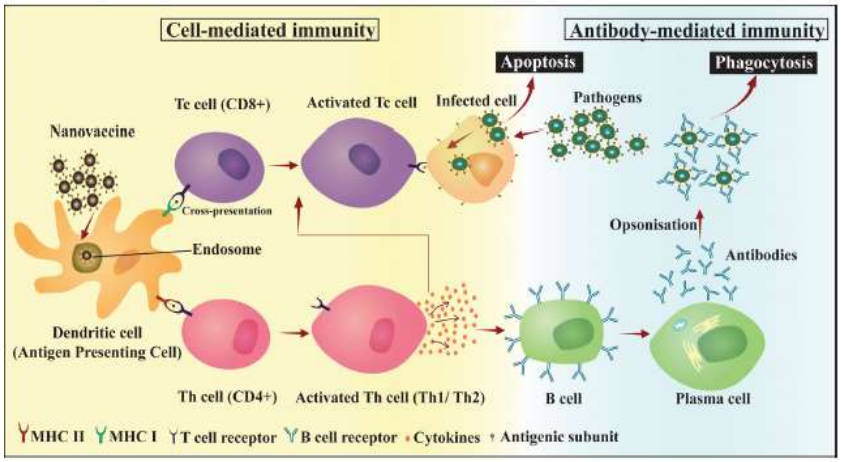


Figure (5): Activation of adaptive immunity by nano-Vaccines: uptake and presentation of APCs produce cell and antibody mediated immune responses leading to Apoptosis of infected cell and phagocytosis of antibody-pathogen complex

2.5.1. NVX-CoV2373

It is a protein subunit vaccine that contains the spike protein of the SARS-CoV-2 molecule. In January 2020, Novavax announced development of a vaccine candidate, named NVX-CoV2373, to establish immunity to SARS-CoV-2.Novavax; Inc. is producing a nanoparticle-based vaccine using antigens derived from the coronavirus S protein. The protein is stably expressed in the baculovirus system, and the product is anticipated to enter phase I trial summer 2020.Novavax entered the final stages of testing its coronavirus vaccine in the UK. Another large trial was announced to start by October 2020 in the US [17].

Fast approval and license of Covid 19 vaccines

During clinical trials, more human subjects are added at each successive phase. Safety, efficacy, proposed doses, schedule of immunizations, and method of delivery are evaluated. The next phase is FDA approval and licensure, which includes oversight of manufacturing and post market surveillance, and may include

Phase IV trials to monitor safety and efficacy, potency, purity, and other potential uses. At any phase, the process can be terminated for various reasons including detection of adverse events, such as serious side effects. FDA has four programs to facilitate and expedite the review and approval of new therapies for the treatment and prevention of serious or life threatening conditions, such as COVID-19. Fast Track, Breakthrough Therapy, Accelerated Approval, and Priority Review allow for expedited processes, such as overlapping vaccine development phases, to bring vaccines to market more quickly. Vaccine developers could potentially use any or all of these programs for vaccine candidates in the United States. FDA can also issue Emergency Use Authorizations (EUA) for review of vaccine candidates that have not completed all phases of development if there is sufficient scientific evidence on the product's safety, effectiveness, risks, and benefits **[18].**

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